1911 • FIFTY YEARS OF SERVICE TO COAL MINING • 1961

# COAL AGE

DECEMBER, 1961

**Operating Guide:**
**Fine-Coal Treatment**
**And Water Handling . . 67**

A McGRAW-HILL PUBLICATION

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## Automated Longwalling in the U.S.... p 50

1861 

1961

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with the development and acceptance
of a revolutionary new quality product which
spectacularly leads *all* competition . . .

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**HULBURT OIL & GREASE CO., PHILADELPHIA 34, PA.**

*Specialists in Quality Lubricants for the Coal Mining Industry*

# Belt's load won't take a spill even when it's on the ropes

THIS rope conveyor takes coal from the mine face to the mother belt—some 2000 feet away. Its partner on the job—a B.F.Goodrich belt made with Nyfil fabric.

Notice how flexible the belt is, how naturally it troughs. It's the use of B.F.Goodrich Nyfil fabrics that makes this belt work so well on a rope conveyor, makes it so flexible it can carry coal at high speeds without spilling a lot of it along the way. And unlike other stiff, boardy belts, a BFG Nyfil belt keeps its cupped shape when empty as well as fully loaded.

It's important to know, too, that B.F.Goodrich makes this belt with a special fire-resisting rubber that'll neither support combustion nor spread flame (U. S. B. M. Acceptance No. 28-6).

Besides making belts safer, this combination of fire-resisting rubber and Nyfil fabric also makes a belt impervious to oil and grease. Makes it highly resistant to the wear and tear of impact, abrasion, gouging. And the fabric used practically eliminates the danger of mildew and rot.

Before you buy or specify a new conveyor belt, think about the safety, performance, low maintenance and long life you can get with a flexible, fire-resisting B.F.Goodrich Nyfil belt. Your nearest BFG distributor can supply full information, or write the *B.F.Goodrich Industrial Products Co., Dept.* ***M-195,*** *Akron 18, Ohio.*

**B.F.Goodrich**

**CONVEYOR BELTS**


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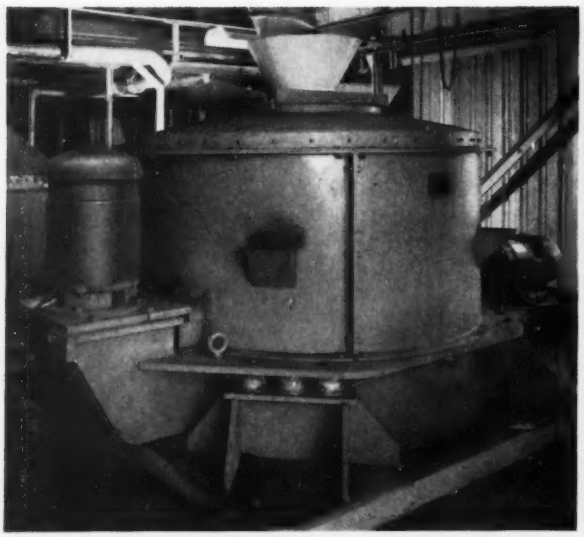
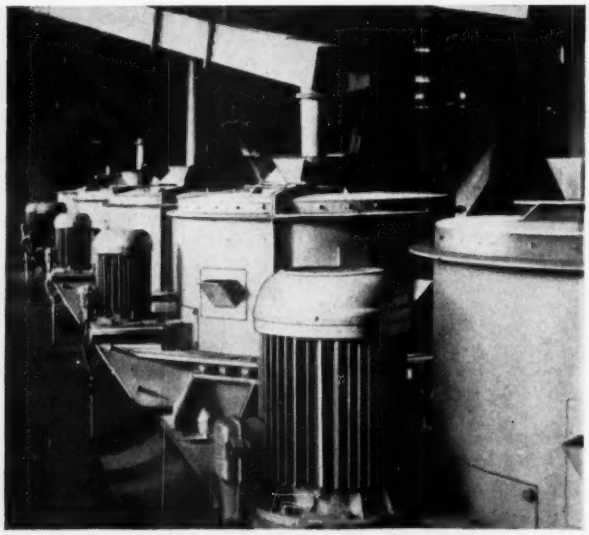
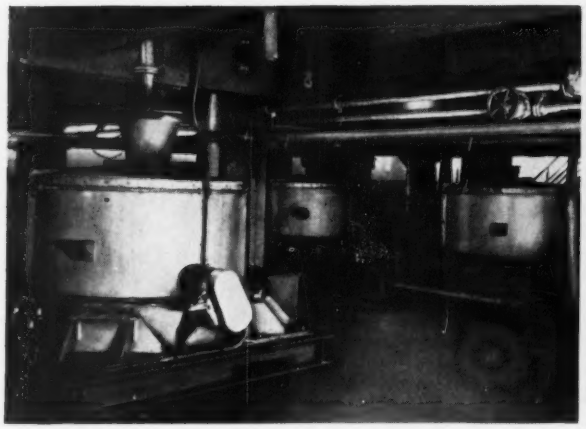
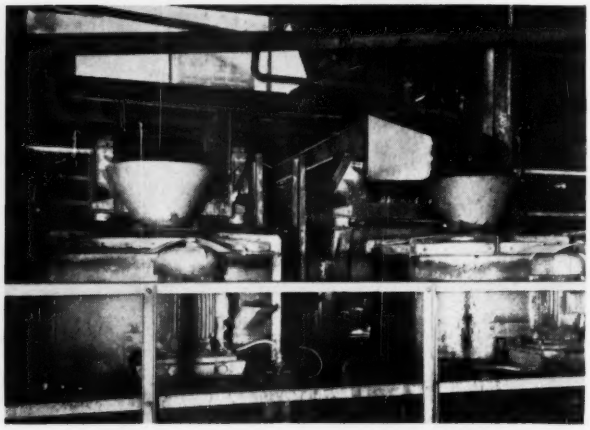
J-27244









## HUNDREDS OF HUMBOLDTS are saving hundreds of tons of coal — hundreds of dollars — in preparation plants all over the world

Why not profit by the years of successful experience that are back of the Bird-Humboldt Oscillating Screen Centrifuge?

Here are some of the Humboldt's outstanding advantages:

**MAXIMUM DRYNESS** — on stoker coal, 2-2½% surface moisture; on minus ⅛", 4-6%.

**MAXIMUM COAL RECOVERY** — 98 to 99% plus, throughout the entire life of the screen.

**MAXIMUM CAPACITY** — up to 100 tons per hour, depending on size of coal and size distribution.

**MAXIMUM ECONOMY** — screens last 3000 hours or more; power is less than 0.2 KWH per ton; rugged construction assures minimum maintenance.

*Ask us to make recommendations and estimates.*

**BIRD** MACHINE COMPANY

**SOUTH WALPOLE, MASSACHUSETTS**

**BUILDERS OF THE COMPLETE LINE OF SOLID-LIQUID SEPARATING EQUIPMENT**

Operators of the **Bird Research and Development Center** for pilot-scale testing to determine the correct equipment for the job. Yours to use.

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# This Month in COAL AGE

December, 1961

## Features:

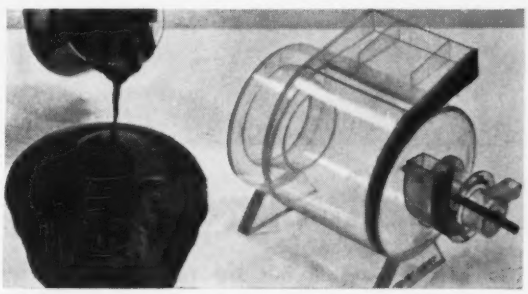


## Meetings:



## Departments:





## Longwall Mining

### Greater Efficiency, More TPM . . . . . p 50

New self-advancing hydraulic roof-support units and longwall coal planer team up to provide better roof control, increase production, reduce manpower more than 50% and minimize maintenance and supply costs. The longwall is 590 ft wide and 1,900 ft long. The top, especially the 1 ft of drawrock common in the Pocahontas No. 3 seam at the Keystone mine of Eastern Gas & Fuel Associates, Keystone, W. Va., was never supported as well as with the hydraulic supports, according to company officials. The company has completed one successful year with the hydraulic roof-support and planer combination. This article details, in part, the results obtained to date.

## Coal Pipelining

### Burning Coal Slurry . . . . . p 56

Recent large-scale test at South Amboy, N. J. shows feasibility of firing coal slurry directly as it comes from the pipeline. Other advances in the art include pipeline transportation of slurry at a ratio of 60-to-40, solids to water, and shipment of this more-stable slurry by tank car or barge. Cooperating in the South Amboy demonstration were Consolidation Coal Co., Texas Eastern Transmission Co., Babcock & Wilcox and Jersey Central Power & Light. The goal is construction of a coal pipeline from northern West Virginia to East Coast.

**Highlight**—How cyclone furnace handles pipeline slurry which has been decanted to 70-30, solids-water.

## Continuous Mining

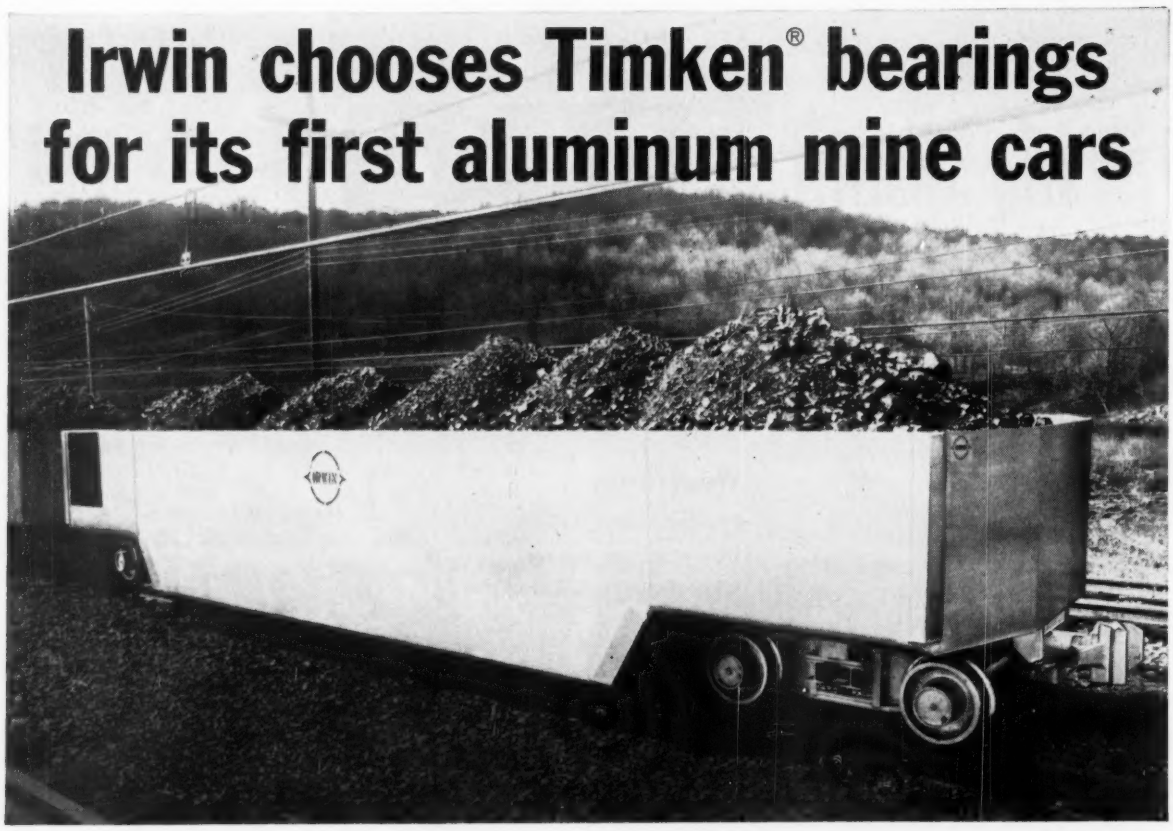
### Conversion to Continuous System Ups Section Output 2½ Times . . p 60

By converting from conventional methods to continuous mining, Lynn Fuel Co., Morgantown, W. Va., boosted production 250% with 53% fewer men. Recovering pillars from the Pittsburgh bed, a seven-man crew produces an average of 375 tons per shift. This average includes time spent cleaning up rock falls and timbering old headings to reach the pillars. The best

(*Continued on p 7*)

COAL AGE, December, 1961, Vol. 66 No. 12. Published monthly by McGraw-Hill Publishing Co., Inc. U. S. subscription rate for individuals in the field of the publication $3 per year, single copies $1 (for rates elsewhere see p 9). **Executive, Editorial, Circulation and Advertising offices:** McGraw-Hill Building, 330 W. 42nd St., New York 36, N. Y. Printed in Philadelphia, Pa.: second-class mail postage paid at Philadelphia, Pa.
**Postmaster:** Please send form 3579 to Fulfillment Manager, Coal Age, 330 W. 42nd St., New York 36, N. Y.

# Irwin chooses Timken® bearings for its first aluminum mine cars

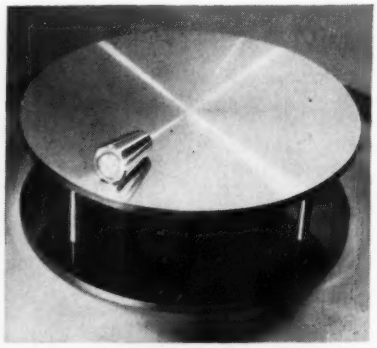


## result: more cars per trip—more trips per car

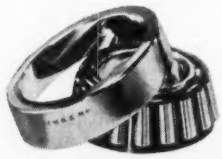
Now Irwin-Sensenich Corporation offers its first aluminum mine cars and they're all on Timken® tapered roller bearings. With these light-weight, yet strong aluminum cars, coal operators can haul more cars per trip, save on power and labor. And because the wheels are on Timken bearings, miners can count on making more trips per car with less maintenance.

With Timken bearings you can be sure of reliable performance. One reason is their uniform high quality. Another is their tapered design that takes *both* radial and thrust loads. And full-line contact between rollers and races gives extra load-carrying capacity. Because Timken bearings have low internal stresses and true rolling motion, they practically eliminate friction. Cars start and roll easier, save power. And because natural pumping action moves lubricant through the bearings, with no outer race grooves to trap dirt, maintenance is reduced. Timken bearings roll trouble-free, longer.

**ON THE SPOT**—that's how bearing problems are often solved by Timken graduate sales engineers. They'll work with you at the design stage, help you select the most economical bearing for your requirements.



**ROLLS FOREVER** in the same circle. This oscillating table demonstrates the accuracy of the taper of a Timken bearing roller. And precision manufacture assures true rolling motion.



**Industry rolls on**

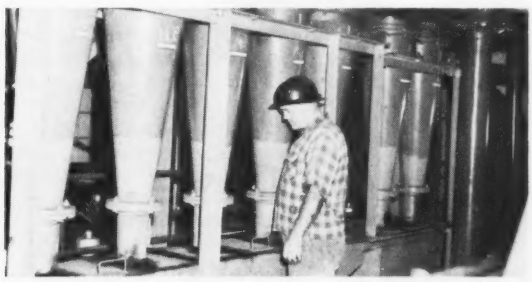
**TIMKEN®**

**tapered roller bearings**

The Timken Roller Bearing Company, Canton 6, Ohio. Cable: "TIMROSCO". Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits. Canadian Division: Canadian Timken, St. Thomas, Ontario.

production shift to date was 600 tons, or 85.7 tons per man. Aside from boosting productivity, the continuous miner has proven itself efficient in clean up work in crossing old workings. Improvement in coal quality is an added benefit.

**Bonus**—How notching of pillars simplifies starting of lifts.



## Operating Guide

### Fine-Coal Treatment and Water Handling . . . . . p 67

Sixth in a series of *Coal Age* Operating Guides is a 16-p section on up-to-date practice and ideas in fine-coal preparation and water handling. Operating principles of the various cleaning units are summarized and mechanical and heat drying units are described. Desliming, flocculation and filtering are major topics covered under solids removal and water handling. Added features are modern flow sheets showing typical applications of various combinations of equipment for cleaning, dewatering, drying and water handling.

## Maintenance Ideas

### A Maintenance Control Program . . . p 86

This article is essentially a description of how a preventive maintenance program was established, the reasons for its establishment and the results obtained. Although your maintenance setup may vary somewhat from the program described herein, you will find a wealth of sound maintenance information that could improve present practices. After all, maintenance is a matter of economics, one of our biggest problems today. And if improvements can be made we should make them.

**Special Information**—Step-by-step details for evaluating maintenance performance, for establishing administrative control, for simplifying paperwork, for programming the actual maintenance work and for reporting to management are included.

(*Continued on p 9*)

# This Month in COAL

**SLOW FINISH—9,000,000-ton weeks continued to be the exception rather than the rule in November, and the pattern will continue to prevail in December, though the average for bituminous is definitely up compared to the early months of 1961—and the windup months of last year. Continuation of the present level into and through next year would alone result in a significant increase in output in 1962—and the rate of the last quarter could be bettered in the months ahead.**

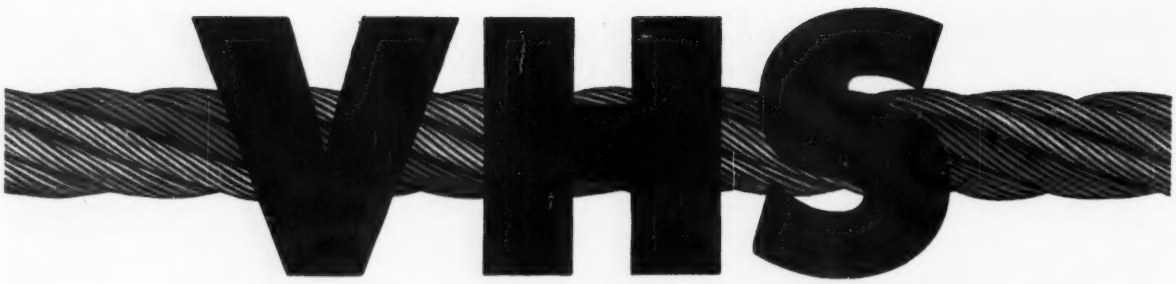
**Anthracite continued to exhibit real staying power in the last part of the year as well as the first, and it now looks as if it will wind up only about 500,000 tons behind 1960—a record bettering that of bituminous. The staying power should persist into 1962.**

**PROMOTION PROGRESS—The proposed new program for putting more pressure behind the promotion of coal use by all possible and economical means, including the stepping up of research, continued in the discussion and planning stages in the last months of the year, with prospects that work actually would get under way on a significant scale in the early months of 1962. Cost and financing continued to be major questions, with the indications strong that the settlement would be another compromise: i.e., same stepup in funds but not the total that some feel the opportunities warrant.**

**GAS PLANS—While evidence continued to mount that coal-based pipeline gas—at least for certain areas—may be much closer than might appear at first glance, the natural-gas industry was making further moves to hold back the tide of competition and thus prevent a slackening or an actual falling off in its rate of growth. Translation of plans into action in the coming months will be evidenced by a major increase in advertising and promotion, with one of the major goals the capturing of the air-conditioning market from the electric utilities, thus at the same time, gas hopes, knocking electricity out of the heating market. Chances for success? Slim, especially if the utilities and coal are on the ball as they should be.**

**WESTERN COMEBACK—Canadian oil and gas are turning out to be as costly as the U. S. products, and competitive nuclear power still is a long way if not forever off. Also low-cost hydro sites are getting fewer and fewer, and even where hydro still dominates, the need for firming-up capacity is becoming more and more of a necessity. All this is resulting in major change in the basis of electricity generation along the Pacific Coast and in the Rocky Mountain area. It is now definite that a lot more coal will be required for this and other purposes, including chemical coke and char. As a result, coal production in the western area is due for a significant jump in the next 2 to 5 yr, with more to come afterward.**

**IN 1962?—The last bituminous wage increase was early in 1959—nearly 3 yr ago. Since that time, but not because of it, coal has dropped significantly in production while the nonunion percentage has tended to rise. But if the pattern of the past should continue to prevail, one question might be: "Is another increase in the offing?" At the moment there is nothing visible to indicate that one is imminent. But 1962 might be the year in which the matter will have to be faced.**

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One green strand identifies American Cable Preformed IPS (improved plow steel) —the long-wearing, general-purpose rope made by the originators of preformed rope. Two green strands identify American Cable VHS—the first new grade of rope ever developed for Very High Strength applications. Two simple identifying symbols. Yet both are of utmost importance when you buy wire rope. American Cable's green strand identification is your assurance that you are getting the rope you ordered. It's your guarantee of made-by-American quality in every foot. And it's our promise that the rope will perform the way we say it will.

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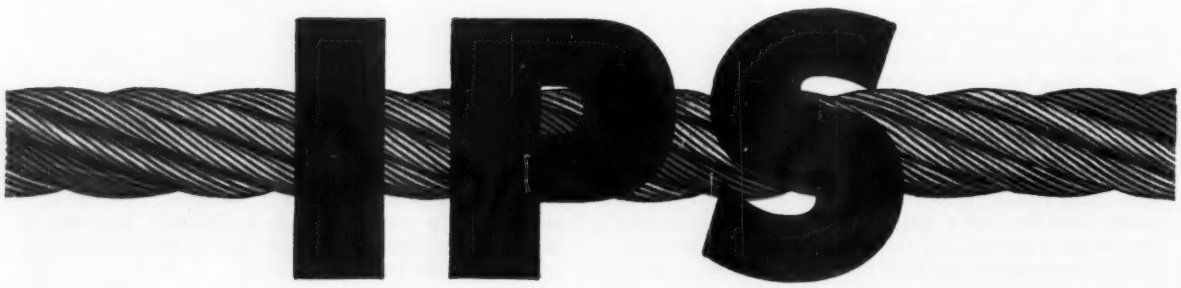

## Mine Safety

**Donald H. Zellers, U. S. Bureau of Mines**

### Trends in Methane Monitoring . . . . p 91

Roundup of research efforts in the development of devices that will provide continuous methane detection and automatically interrupt power at a specified concentration is presented by the author. Designs for methane monitors are discussed, including operating principles, elements of construction, methods of installation and so on. Also included is a survey of overseas developments in methane monitoring, one being a stationary type.

**Items of Interest**—Illustrations in the article by Mr. Zellers include a schematic program of circuits in the miniature detector and photos of assembly details of the prototype device.

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COAL AGE, VOLUME 66 — DECEMBER, 1961, NUMBER 12

COAL AGE, with which are consolidated The Colliery Engineer and Mines and Minerals, is published monthly by McGraw-Hill Publishing Co., Inc. Founder: James H. McGraw (1860-1948).

**SUBSCRIPTION PRICE:** Available only by paid subscription. Publisher reserves the right to refuse nonqualified subscriptions. Subscriptions to Coal Age solicited only from executives, management, engineering, operating and supervisory officials associated with companies engaged in the mining and preparation of anthracite, bituminous and lignite coal. POSITION AND COMPANY CONNECTION MUST BE INDICATED ON SUBSCRIPTION ORDERS. Send to address shown in the box below. U. S. and possessions and Canada, subscription rate for individuals in the field of the publication $3 per year, $5 for 3 years, single copies $1; elsewhere $15 per year, $40 for 3 years payable in advance; single copies $2.

**EXECUTIVE, EDITORIAL, CIRCULATION and ADVERTISING OFFICES:** McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y. Telephone: Longacre 4-3000. Teletype: TWX N. Y. 1-1636. Cable address: McGRAW-HILL, N. Y.

Audit Bureau of Circulations

Associated Business Publications

Printed in Philadelphia, Pa.; second class mail postage paid at Philadelphia, Pa. Title ® registered in U. S. Patent Office. 

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COAL AGE articles are indexed by Engineering Index. Coal Age's own index is published annually in the December issue.

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# THIS MONTH . . . in Mining Practice

**MORE PRESSING—Continued investment in higher-capacity equipment and development of more-efficient methods boosted bituminous tons per man at least another 0.7 in 1961, bringing the average to 13.5 or more, compared to 12.83 in 1960. But investment to achieve increases such as this continues to climb, putting more of a premium on increased machine utilization time. Raising the number of shifts for a miner from 8 to 12 per week can cut cost from 10 up to 20¢ per ton, as an example. When unit costs rise to $¾ to $1 million, as they well could for robot setups, the pressure will be to get as near 21 shifts a week as possible.**

**DIESELS AT THE FACE—Recent installation of a diesel shuttle car at a Utah coal mine has shown up the fact that truck coal mines in that state have been using diesels at the face since 1956. The majority are modifications of standard trucks equipped with either purchased or mine-designed scrubbers, but in addition to the shuttle car the equipment includes one rubber-tired locomotive used over 2,000 hr since July, 1960, pulling 5-ton drop-bottom rail cars in 5½- to 6-ft coal. It and all the trucks pull from face to dump. The units have piled up an enviable record safety- and efficiency-wise.**

**HYDRAULICKING HERE—It is now definite that hydraulic mining will be widely used in operations with sufficient pitch for the coal to run on the bottom. It is now in actual commercial use in Washington, in addition to an experimental installation in anthracite, and is being considered by other pitching-coal operators. With 3- and 4-man crews, outputs of 90 to 100 tons per shift already are being achieved, and the cost of the mining unit is in the low low bracket.**

**FINE COAL—Though there will be some increase in raw-coal plants, it is not likely that the standard cleaning plant will be seriously challenged. Since water or medium is employed in most of the preparation plants, and since pollution prevention has become mandatory, most plants are really two in one—regular preparation and, as an adjunct, water treatment and handling. The latter represents real money. Whether this will bring air cleaning farther into the picture still is problematical. In any event the cost of processing water is enough to warrant major research into ways and means of alleviating the burden.**

**HIGHER VOLTAGES—Backers of a higher—much-higher—face voltage continue to work quietly and persistently to gain acceptance for 2,300 and preferably 4,000 V for underground face equipment. Though their number is as yet small and the road stretches out pretty far ahead of them, there is much merit in their contention. A voltage of this magnitude would go far toward alleviating some of the cable, motor-maintenance and other problems involved with 250 and 440. And the electrocution hazard, relatively, is increased very little if at all with modern cable and motor constructions and grounding practices, plus greatly reduced man exposure to the possible hazard of fatal electric shock.**

This is
AMERICAN OIL COMPANY
in action

## BY C. L. "CHARLIE" BROWN

**About the Author.** Charlie Brown is a lubrication specialist. His eleven years of experience in such work are only part of his qualifications. He majored in math and physics at Eastern Illinois State College and he has completed the Company's Sales Engineering School.

★ ★ ★

On the coal washing equipment at Crown Mine they were experiencing trouble with the lubrication of the air valves. Because the grease wasn't getting in to do the lubrication job, valves were sticking. Working with the General Top Foreman, we recommended RYKON Grease "R." This is a grease with unique properties. It flows like an oil, but the shearing action exerted by working pressures irreversably converts the fluid to a grease. Since switching to RYKON Grease "R" in the washing jigs there's been no grease leakage and the valves work freely.

This is one instance where we helped solve a problem. But our big job was surveying the lubrication needs of the preparation plant at the time it was built. This was done and lubrication recommendations were made to insure the most economical operation of the plant. We solved the mine's problems on inventories, too. With warehouse facilities only 12 miles from the plant, we're able to keep supplies of needed products available for immediate delivery. This cuts inventory costs and provides insurance against having to wait for deliveries.

★ ★ ★

Is this the kind of product performance and service you're looking for? Get it by calling the American Oil Company office near you.

*Quick facts about* **RYKON® Grease "R"**

- Flows like an oil. Under shearing action converts to grease.
- Resists moisture and protects against corrosion.
- Stable under high temperatures.
- Mechanically and chemically stable.

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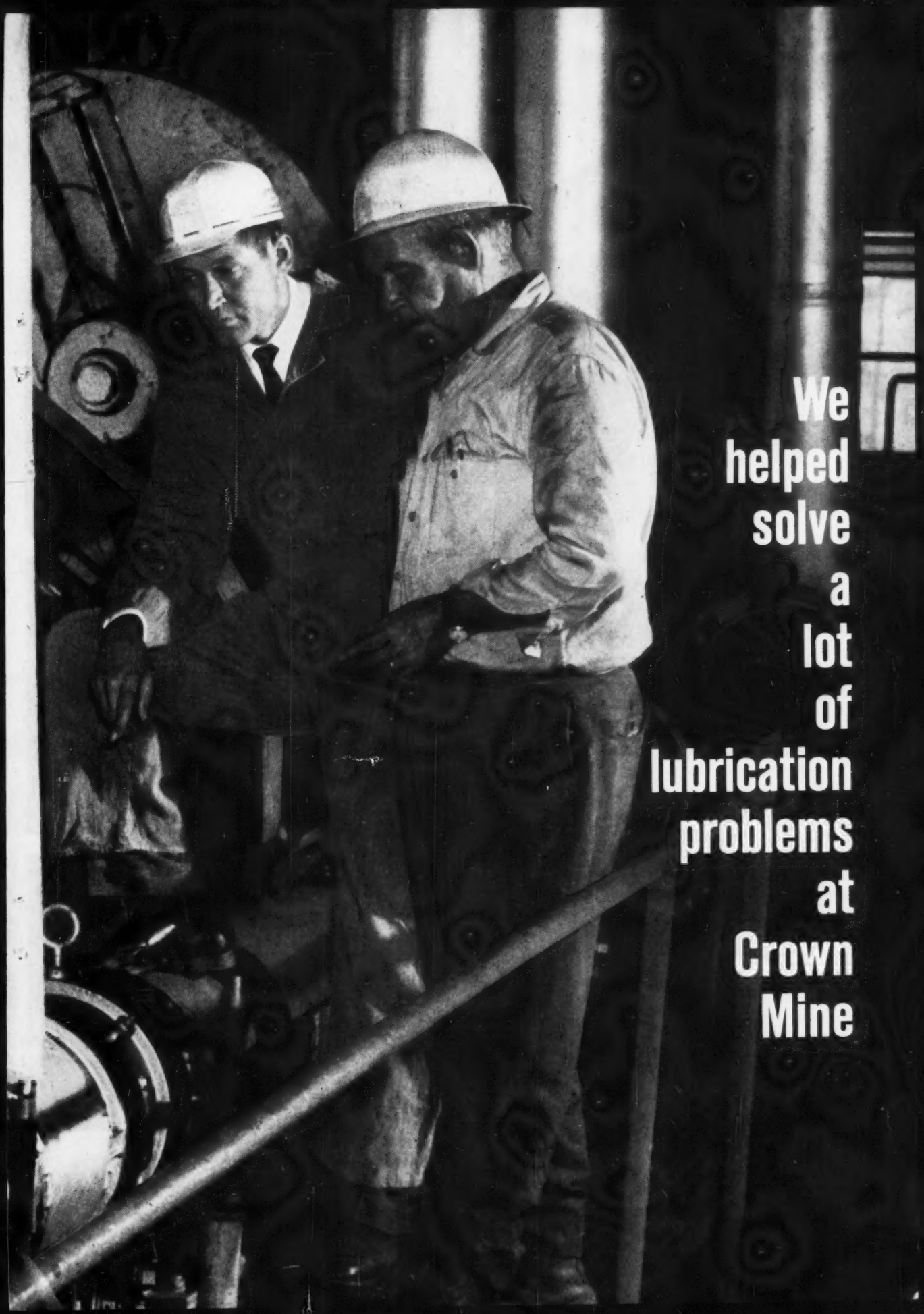
Get in the plant and find out how things are going. American Oil representative Charlie Brown does this. Here he discusses lubrication with Bob Boyett (right), Crown Mine General Top Foreman.


We
helped
solve
a
lot
of
lubrication
problems
at
Crown
Mine

# Long-Airdox face preparation team sets fast pace for high-capacity mining systems

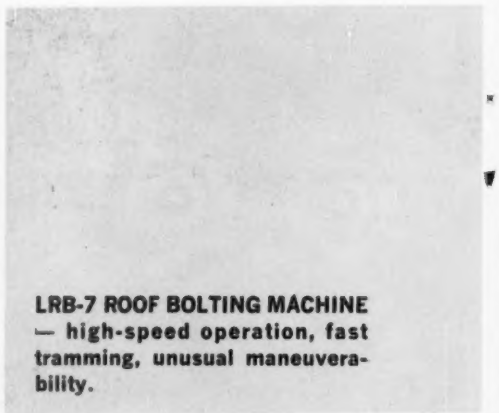
Here is how to have faster face preparation and higher production with lower costs—regardless of seam height. Take advantage of the superior speed and flexibility of this unique Long-Airdox face preparation team . . .

LRB-7 ROOF BOLTER. The most versatile and powerful machine of its type. Offers highest torque and thrust; most effective internal, through-steel dust collector; fast easy operation; low-maintenance hydraulic system.

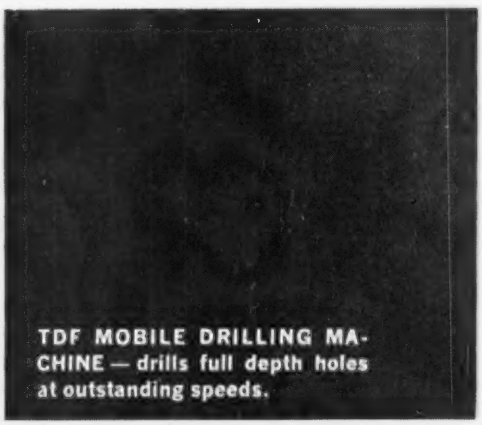
TDF DRILLING-SHOOTING MACHINE. Makes it possible for one man to handle both drilling and shooting in comparable time with either cutting or loading. "Rotary-Thrust" drilling principle applies thrust closer to face than any competitive machine. Three models for all seam heights and conditions.

AUTOMATIC AIRDOX SHOOTING. Faster than any other system and gives better product. Lighter weight automatic discharge tubes; sequence shooting of any number of holes in a single operation; and single-unit TDF drilling, multiple-shooting machine (which transports tubes and sequence valves) now make this system practical and economical for all conventional mining.

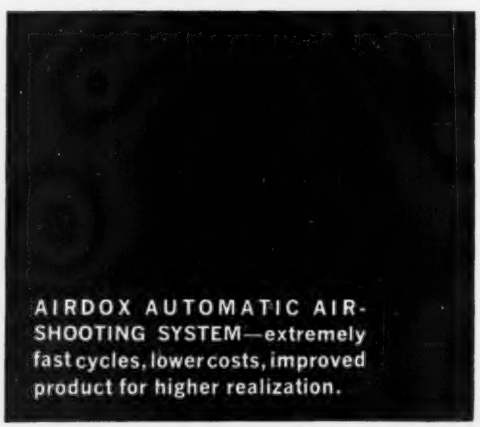
For facts and figures, write Long-Airdox, Oak Hill, West Virginia.



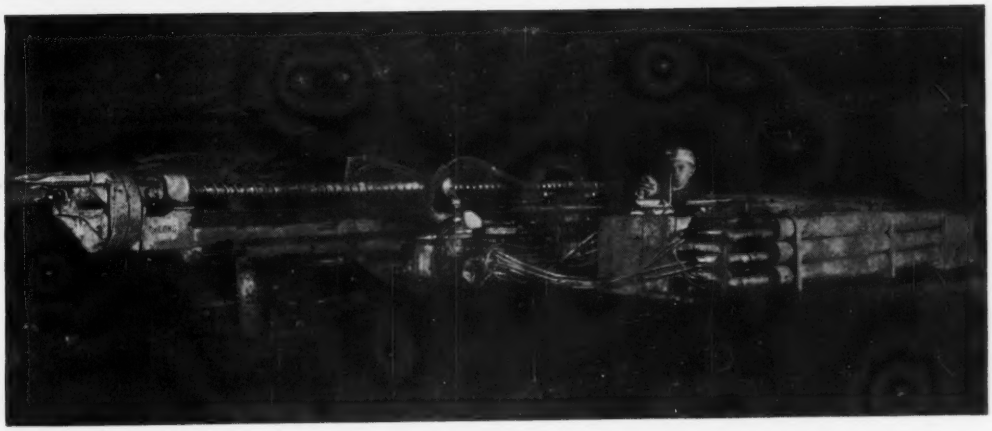
**LRB-7 ROOF BOLTING MACHINE — high-speed operation, fast tramming, unusual maneuverability.**

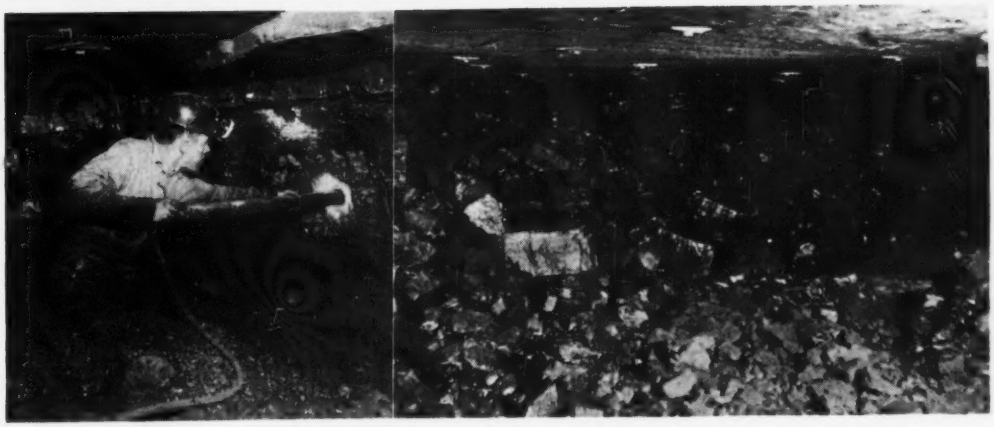


**TDF MOBILE DRILLING MACHINE — drills full depth holes at outstanding speeds.**



**AIRDOX AUTOMATIC AIR-SHOOTING SYSTEM—extremely fast cycles, lower costs, improved product for higher realization.**





# LONG-AIRDOX

# Trackwork like this keeps things humming

In this West Virginia yard, coal trips brought from underground are fed to a rotary dumper in a continuous string, then returned underground promptly.

An ingenious layout design was one of the factors in bringing this marvel of efficiency to reality. Tailor-made special trackwork was another. Bethlehem engineers worked closely with the customer in planning and designing this layout.

Bethlehem shops prefabricated all trackwork, including the three diamond turnouts shown in the photograph, and a three-way switch at the discharge end of the dumper. Operations throughout the yard maintain a steady hum of efficiency.

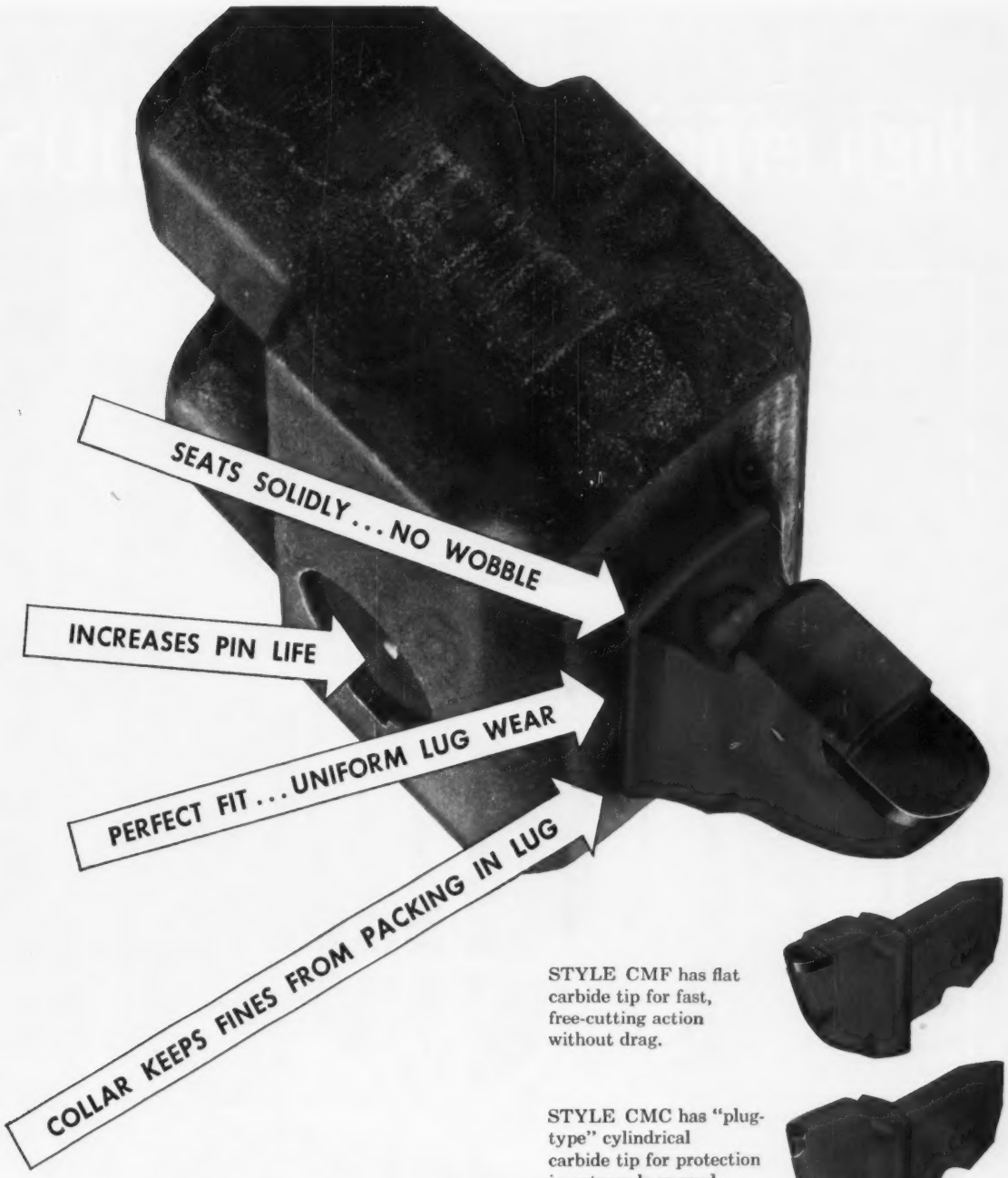
This is a fine example of Bethlehem engineering teamed with forward-looking mine management to produce money-saving results. If you suspect there may be weak spots in your transportation system, our engineers will gladly help you strengthen them. Just get in touch with our nearest office.

Steel *for Strength*
*. . . Economy*
*. . . Versatility*

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
*Export Sales:* Bethlehem Steel Export Corporation

**BETHLEHEM STEEL**

BETHLEHEM STEEL






STYLE CMF has flat carbide tip for fast, free-cutting action without drag.



STYLE CMC has "plug-type" cylindrical carbide tip for protection in extremely rugged cutting conditions.

# WOBBLE-FREE RED BITS

## with uniform lug wear

V-R Red Bits, have carbide tips manufactured especially for mining by V-R. Call your representative today and put these "wobble-free" V-R Red Bits to work on your equipment.

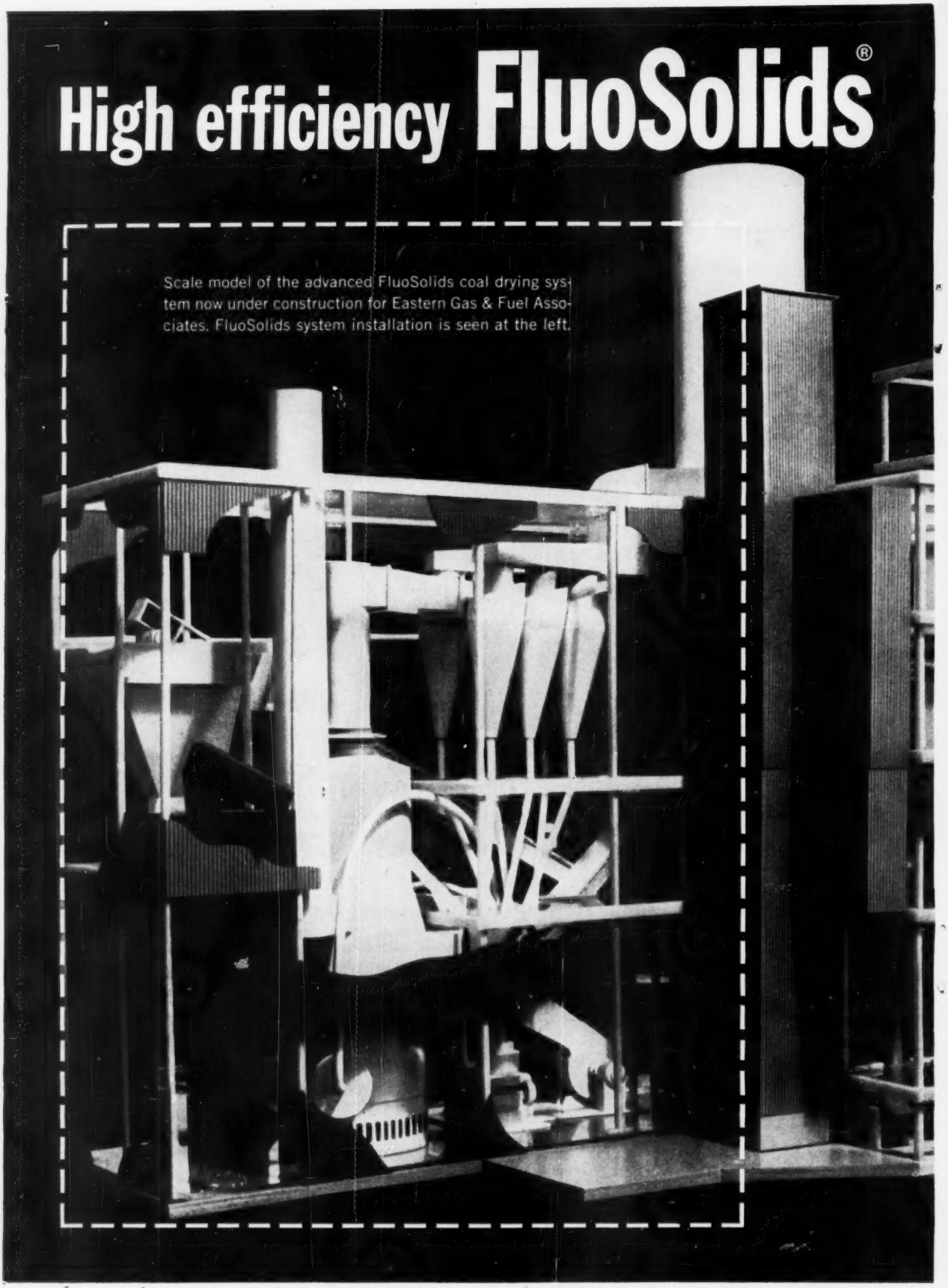
VASCOLOY-RAMET CORPORATION
856 Market Street, Waukegan, Illinois

V-R

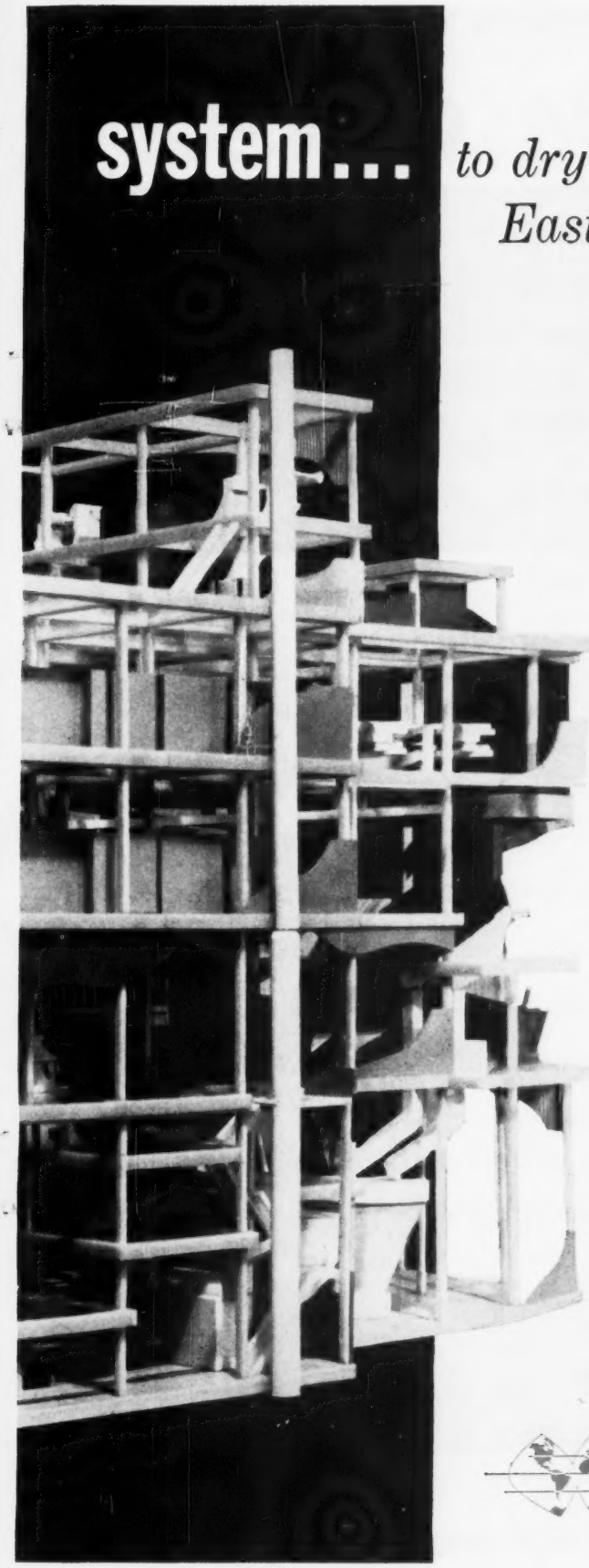
**FIRST CHOICE in more and more mines**

M-841

# High efficiency FluoSolids®



Scale model of the advanced FluoSolids coal drying system now under construction for Eastern Gas & Fuel Associates. FluoSolids system installation is seen at the left.



# system... *to dry coal for Eastern Gas & Fuel Associates at Federal No. 1 mine*

Designed to remove up to 33 tph of water, a Dorrco® FluoSolids system now under construction for Eastern Gas & Fuel Associates, at Grant Town, W. Va., soon will rank as one of the most significant coal drying installations in the East.

With start-up projected for late 1961, the new unit will process 465 wet tph of ¾″ x 0 coal, evaporating 33 tph of water.

Since its introduction in 1954 the Dorrco FluoSolids coal dryer has established unrivalled standards of efficiency and economy . . . wherever it has been installed. The hard-fact reasons why are these—

**The FluoSolids dryer conserves space**... because it is of compact, unitized design. It provides rapid start-ups and shut-downs... it burns pulverized coal, today's most accepted means for efficient fuel utilization.

**The FluoSolids system saves fuel**... none is consumed during shut-down. The system adjusts quickly to variations in feed conditions... because feed rate is controlled instrumentally and automatically.

**Uniform fluid bed temperature,** varies no more than 5 degrees F., with no localized hot spots. Because of the inherent characteristics of a *true* fluid bed obtained only in a Dorr-Oliver FluoSolids reactor, drying is uniform, resulting in a product which will meet specified requirements.

**The controlled humidity exit conditions** in the FluoSolids reactor promotes high cyclone collection efficiency and eliminates dusting conditions due to over-dried fines. Result—a white stack.

**Power costs are lower** . . . since the FluoSolids dryer operates with lower air volume than any other system. Feed size can range from filter cake on up to a top size of 1½″ coal. And the FluoSolids dryer handles small tonnages as readily as feed rates up to 800 tph.

Your coal preparation facility will be more efficient and more economical with a Dorrco FluoSolids coal drying system . . . engineered for your facility.

For complete information on today's most advanced coal dryer write Dorr-Oliver Incorporated, Stamford, Connecticut.

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## You get all these advantages with the new

# Lee-Norse CM32

- "TOUCH AND GO" VERTICAL ACTION TRAMS LOW, CUTS HIGH
- MORE POWER — THREE 50 hp MOTORS, AC or DC (75 hp motors also available)
- LOWER — 32 INCHES HIGH
- FASTER — UP TO 80 FPM
- HEAVIER — 27 TONS
- CUTS THE DIAMOND PATTERN

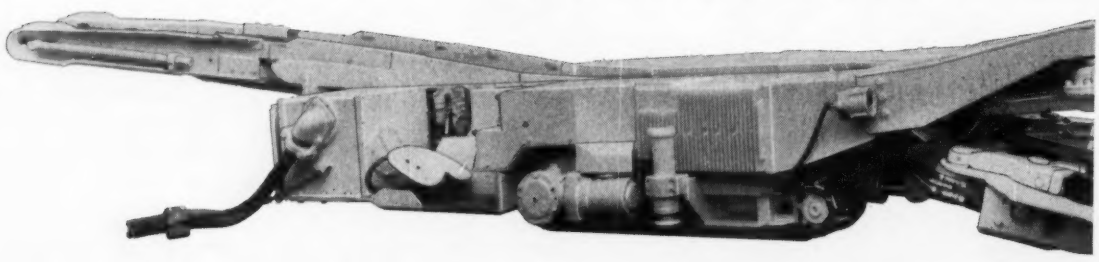
## . . . the CM32 provides these benefits

The Lee-Norse CM32 MINER is designed to mine coal selectively from medium seams, ranging from 36″ to 68″ in thickness. Selective mining assures cleaner coal and reduced cleaning costs.

Low tramming and high cutting features increase coal production at extremely low operating costs.

Free-cutting action in a diamond pattern continuously gives uniformly coarser raw coal. The percentage of ¼ x 0 equals that for conventional mining, while per-

The CM32 is 32″ high, cuts coal from 36″ to 68″.



**Coal High or Low . . . Lee-Norse MINERS keep production on the go!**

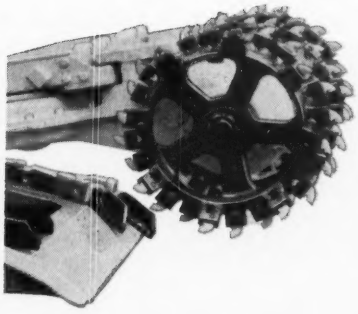
# "Low Coal" MINER

The business end of the CM32 shows placement of cutters to provide a diamond pattern. Note dual gathering arms of gathering head, and large throat opening of conveyor.

centage of ⅛ x 0 is generally about 2 per cent less. Ash content of ½ x 0 fraction has been proved to be less than that mined by other methods.

The use of parts proved and tested in larger machines assures less maintenance, fewer replacements; this means low maintenance cost and less downtime.

**Coal production runs high, with profits at a new high level.**



**SEND FOR BULLETIN NUMBER LN 612**

LN Lee-Norse Company

CHARLEROI, PENNA.

**Specialists in Coal Mining Equipment**

# New M-S-A® Pager gives you the convenience and flexibility of a telephone with the amplification of a loud speaker

Now, with one versatile communications unit, you can page key personnel over a loud speaker or converse semi-privately by phone. A flip of the switch on the new M-S-A Pager lets you do either.

### Uses Existing Lines

The new unit is a completely self-contained, transistorized telephone. Individually battery-powered, these units utilize existing phone lines, and can be used in conjunction with most other telephones.

### Simultaneous Paging

Ten or more Pagers can be installed on a single line. This makes it quite simple to page key men from a number of points . . . simultaneously. Once the man answers, a flip of the switch converts the Pager into a regular telephone for private or semi-private conversing.

### 24 Volts for Paging . . . 12 Volts for Talking

Two dry cell batteries provide the power source. And the power is expended only when the unit is in use, thus conserving battery life. Estimated battery life: 2 to 3 months on a 5% duty cycle.

### Easy Installation and Maintenance

Weighing about 25 pounds, the M-S-A Pager can be mounted on a timber or a rib. All parts readily accessible with removal of four fastening screws which open the front half of the case. Transistors are vibration-proof . . . no filaments . . . so high efficiency, long life are assured.

For additional information, ask the MSA representative to call. And write us for helpful new product data bulletin.

Mine Safety Appliances Company, Pittsburgh 8, Pennsylvania. In Canada: Mine Safety Appliances Company of Canada, Ltd., 500 MacPherson Avenue, Toronto 4, Ontario, Canada.

**MINE SAFETY APPLIANCES COMPANY** MSA

# How we took the kinks out of USS Amerclad cable

That baffling illustration diagrams the torturous path taken by electrical mining cable in a machine we designed to duplicate actual service conditions right in the Laboratory. Nothing ruins electrical cable faster than reeling and paying off a kinky, twisted cable under tension. A sudden snap can tear a conductor right out of the cable. We couldn't expect miners to baby electrical cable, so we designed the test machine to make sure they don't have to. It tests abrasion resistance, reeling under tension, heat aging, flexing and kinking.

The result is USS Tiger Brand Amerclad mining machine cable. Our testing has enabled us to design a cable that takes tension evenly on all conductors so that it doesn't kink or twist, and to insulate and jacket it with specially compounded materials to resist heat aging and abrasion. And we have the test results to prove that Amerclad's construction soaks up shock, vibration, and stands up to crushing impact, severe jerking and pulling. It's the toughest electrical cable money can buy.

For every special job there's a standard USS Tiger Brand wire and cable. For the complete story on Amerclad cable, write American Steel and Wire, Dept. 1218, Rockefeller Building, Cleveland 13, Ohio.

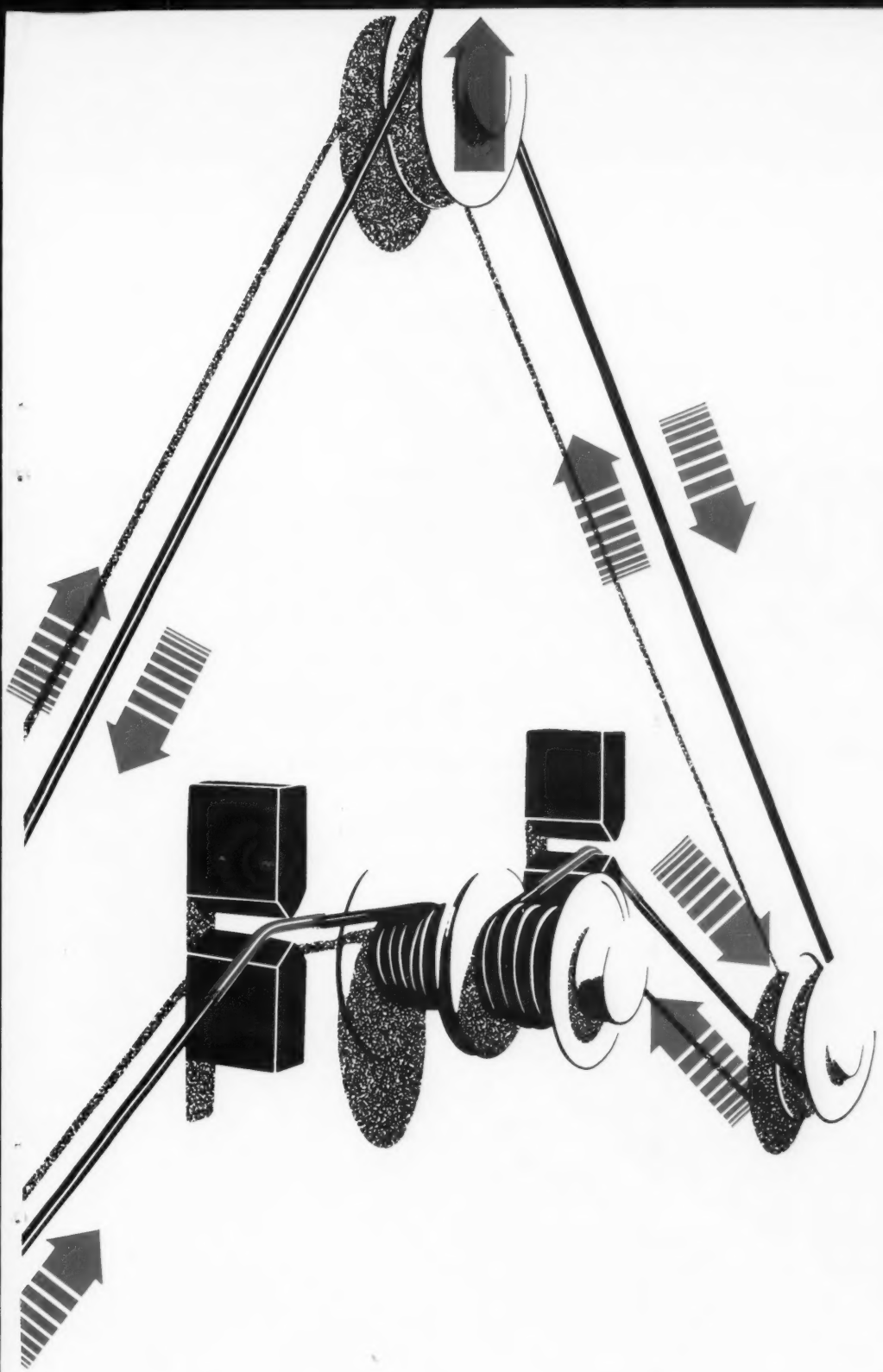


Cable under 100 pounds tension is reeled back and forth until failure.

Adjustable counterweights on middle sheave keep cable under tension.

Distributor guides are principal wear points to cable. Sheaves are secondary wear points.

Cable under 55 ampere load during test.



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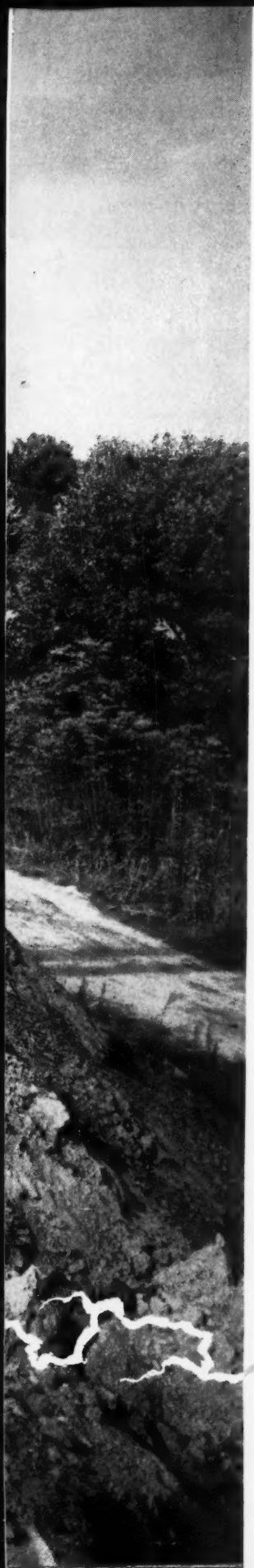
STATIC
CONTROL



**Step up and meet the big 270-B** . . . longest range 2-crawler stripping shovel ever built! There's a new crowd system . . . all-enclosed gear-propelling . . . automatically lubricated, all-enclosed main machinery . . . and dynamic **STATIC CONTROL.** Here's control that lets you handle this million-pound giant like a small rig . . . that eliminates rotating parts and expensive electronic tubes. It delivers split-second response with a higher bail pull at any selected speed, reduces shock loading and puts the greatest digging force and speed to work the instant they're needed. It's control like you've never seen before . . . it's **STATIC CONTROL** — first by Bucyrus-Erie. Your operations can use this kind of performance . . . and we'll rush you all the details if you'll write Bucyrus-Erie Company, South Milwaukee 1, Wisconsin.

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**The only moving part on the STATIC CONTROL system is the operator's hand on the controller!**

# News Roundup

## Coal Wins Support In Pacific Northwest

By Ray Bloomberg
McGraw-Hill Pacific Coast News Bureau
Seattle, Washington

**Coal took the play away from nuclear energy as a power source at a meeting of the Washington State Power Advisory Committee Oct. 27 in Seattle.**

Construction of a generating plant at the Atomic Energy Commission's Hanford Works, converting heat created in the manufacture of plutonium at a new reactor, was discussed by Earl Coe, director of the State Department of Conservation; John Riley, assistant state attorney general, and Owen Hurd, managing director of the Washington Public Power Supply System.

Coe declared his department's only interest is in getting the power facilities built and that the state would withdraw from the power business as rapidly as possible. Hurd, whose organization previously had indicated it would be interested in building the nuclear generation project if the state did not, said only "this is not the time to worry about who is going to do the job." Riley gave a "preliminary and tentative" opinion that the state has authority to erect power facilities.

### Studies Indicate Coal Can Compete

**Sol E. Schultz, Seattle manager of H. Zinder & Associates, consulting engineers, spoke for coal. New economic studies indicate that a 500,000-kw plant to generate electric energy from coal, under financing by revenue bonds, can be a competitive source of power for the Pacific Northwest in the years just ahead, he said.**

Schultz gave the committee a preliminary report on studies being undertaken by his firm for the Kittitas County Public Utilities Dept., with funds provided by the Department of Conservation. The study reviewed a 1958 report focused primarily on a 250,000-kw plant.

An investment of $52,460,000 currently would be required for a 250,000-kw plant and $80,198,000 for a 500,000-kw plant, including mining equipment, Schultz said. Working capital and financing costs would bring the total amount of a bond issue to $60,500,000 or $240 per kw for the smaller plant and $93,000,000 or $186.50 per kw for the larger plant.

The 250,000-kw plant would have an overall operating cost ranging from 6.98 mills per kwhr at 50% annual load factor down to 4.77 per kwhr at 90% load factor. On the same basis, the larger plant could operate from 5.82 to 4.06 mills, Schultz reported.

"I am convinced that economies can be made in fuel costs, particularly with the use of newly-established methods for hydraulic mining, that would bring the cost of electric energy from a 500,000-kw plant down to the range of 3½ to 4 mills per kwhr," declared Schultz.

If dump power could be obtained at no cost from dams of two other PUDs on the Columbia River and integrated with power from the steam generating plant, a blended cost of about 2 mills per kwhr could be obtained, the committee was told. This would be lower than most new projects now proposed in the Pacific Northwest, he said.

### Interest in Coal Heightens

**Failure of Congress to authorize generation of electric energy at the new Hanford reactor, delay in Canada's signing of the Columbia River treaty and fading of prospects for early construction on the Middle Snake River because of the fish controversy are responsible for heightened interest in steam generation from coal, declared the engineer.** The Kittitas project requires no legislation, has no quarrel with fish interests and could deliver power within 3 yr after money became available, Schultz said.

Zinder's preliminary data will be circulated soon to Pacific Northwest utilities to obtain indication of interest.

## New Markets for Coal Seen in Rail Affiliation

**The proposed merger of the Norfolk & Western Railway, Nickel Plate Road and Wabash Railroad brought unqualified support from coal spokesmen at Interstate Commerce Commission hearings held in October.** Among manifold benefits coal would derive from the affiliation is a chance to recapture many Midwestern markets since it would provide an efficient one-line service between the Virginia-West Virginia coal fields and Cleveland, Detroit, Chicago and St. Louis. An increase in the number of available coal cars and the use of larger N&W cars on the Nickel Plate and Wabash tracks would also be realized from the consolidation.

S. Austin Caperton, president, Slab Fork Coal Co., told ICC that the merger would help the system hold the line on freight rates which is one of the coal industry's major cost factors.

N&W President Stuart T. Saunders outlined financial and operational plans that would expand the N&W into a $1.7 billion company. These plans include a major improvement program costing $35.7 million which would involve new trackage and enlargement of yard facilities in half a dozen cities.

Three lines opposed to the merger unless they are made part of it are the New York Central, Erie-Lackawanna and the Akron, Canton & Youngstown railroads. N&W, however, is opposed to any of these three joining the consolidation.

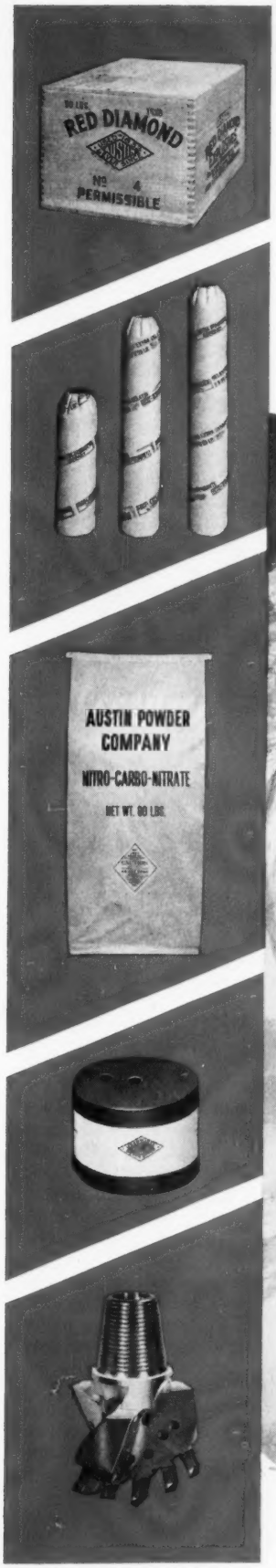
### In This Section



## USBM Steps Up Research in West

**The Denver coal research laboratory of the U. S. Bureau of Mines has embarked on studies which will emphasize new uses and broader markets for solid fuels.** The $127,000 program is part of a $1.7 million operation this fiscal year for Denver area units of the bureau.

Another segment of the operation involves a $239,700 program under which industrial engineering studies and systems-analysis research will be conducted




# Merry Christmas! Happy New Year!

at mining operations. Improved efficiencies and lower operating costs are the goals. Under a $418,700 mineral resources program, projects will be conducted to provide more information on the region's fuels and minerals, in relation to national needs. Also administered from Denver, a $778,800 health and safety program in 12 Western states and Alaska will provide for inspections of mines, investigations, rescue work and control work on fires in coal deposits.

## TVA Receives Coal Land In Litigation Payment

**The Tennessee Valley Authority has accepted a seam of Kentucky coal under 8,800 acres in Bell and Harlan Counties in partial settlement of a million-dollar law suit the federal agency prosecuted against Cumberland Gap Coal Co., Inc.**

The compromise settlement of $150,000 also included a cash judgment of $41,448 to be paid by Maryland Casualty Co., Inc., which had executed a performance bond to stand good for the coal firm if it failed to meet its contractual obligations to TVA.

TVA made a contract with the coal company in 1955 to supply 5,000 tons of coal a week for delivery at the Kingston Steam Plant. Litigation was initiated in Chattanooga, Tenn., when the coal firm defaulted in deliveries to TVA. U. S. District Judge Leslie R. Darr found that the coal company misrepresented to TVA that it was a coal producer with 30 yr experience; that it controlled coal reserves with 15 million tons, and that it produced 265,000 tons in Tennessee the preceding year. Actually, the company did not control any coal reserves, had no production staff and, in fact, depended on other producers to provide its contract commitments. Eventually these producers ceased to supply Cumberland and deliveries to TVA stopped.

Thomas A. Pederson, member of TVA's legal staff, said he did not know the potential supply of coal that will be available and explained that the federal agency had to take the best settlement it could get.

## M. A. Hanna Coal Reorganizes

**The M. A. Hanna Co., on Oct. 11, approved a plan to dispose of the company's direct operating activities in the coal, iron ore, steel and shipping industries and convert to a closed-end investment company with assets of about $500 million.**

The company's anthracite coal business—Susquehanna Collieries Div.—has been acquired by the Susquehanna Coal Co., a new and independent group. About

(*Continued on p 30*)

## R. Dawson Hall Passes Away

**R. DAWSON HALL**, a member of the original editorial staff of *Coal Age*, passed away Nov. 13 at the age of 88.

"R. Dawson," as he was universally known, joined *Coal Age* July 14, 1911, several months ahead of the first issue, and spent 35 yr on the editorial staff, retiring as engineering editor at the end of 1946. Several times in the interim, he took over complete responsibility for the magazine's editorial operations. The first time was in 1919 when Floyd W. Parsons, chief editor, resigned to become an independent journalist. Mr. Hall then took over engineering and production as co-editor with C. E. Lesher in 1920. When Mr. Lesher left to join Pittsburgh Coal Co. in 1924, Mr. Hall again assumed responsibility until 1927 when John M. Carmody was appointed editor, permitting Mr. Hall to return to the engineering editor post.

An early advocate of better working conditions, greater safety in mines and the use of machinery to increase efficiency and place the industry in a better competitive position, Mr. Hall was largely responsible for the leadership of *Coal Age*, in these fields. His interests in mining also resulted in various technical papers which he prepared as an independent engineer. Roof and roof control became one of his specialties and his method of showing roof action by breaking a cigar across his knee became a classic in coal mining history.

Born in England, R. Dawson received his early education in private schools at Lansing in Sussex County. Later he attended the University College School in London for 4 yr and then matriculated at London University. Following this, he attended University College, winning the junior Gilchrist scholarship and aimed his education toward civil engineering. His conversion to mining engineering followed his coming to the U. S. in 1892 when he entered the employ of Alfred Herdman of Ridgway, Pa., who was then engineer for the Shawmut interests. Upon Mr. Herdman's resignation, Mr. Hall succeeded him as chief engineer of the company, remaining with this concern until 1901 when he resigned and moved to Du Bois, Pa. There he opened an office as consulting engineer, continuing until 1911 when he was called upon to help set up the editorial program for the new *Coal Age* magazine then in process of organization.

Mr. Hall's interests, however, were considerably broader than the coal industry alone and he has given largely of his time and energies to church, community and society affairs. His society and institute affiliations include the AIME on whose Papers and Publications Committee he served for many years, American Mining Congress, National Safety Council, Rocky Mountain Coal Mining Institute and others.

Mr. Hall is survived by his wife, Hannah M. Hall, and stepsons, William L., James L. and John P. Pearson.

UNEQUALLED MINING ACCEPTANCE!

UNRIVALLED MINING EXPERIENCE!

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GOLD LINE

## The ORIGINAL PVC MINE BELTING

First in the mining field, first in sales and performance, Scandura is the solid-woven polyvinyl chloride belting that made all the records in the beginning . . . and is building the most today! Months and years of experience on some of the most difficult applications ever assigned to conveyor belting give the crown to *Scandura* —the lighter weight, flexible, oil resistant belting certified fire resistant, immune to ply separation, mildew and rot under the worst conditions. Scandura Gold Line holds the cost line, too! See your National Mine man for quotations on your needs.

Manufactured in Charlotte, North Carolina by Scandura INC.

**Exclusive Distributor**

**National Mine Service Company**

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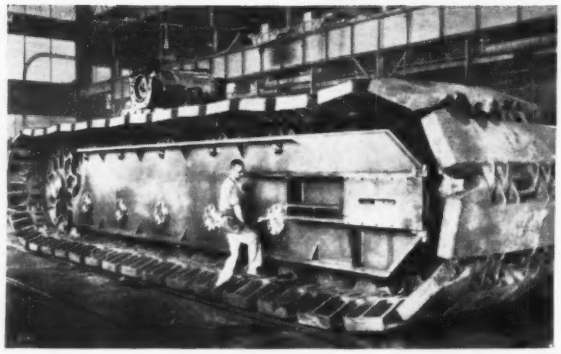

## Immense Stripping Shovel Ordered by Peabody Coal

**COLOSSAL 400,000-LB CRAWLER** pictured here is the first of eight such units destined to become part of the world's largest mobile land machine – a mammoth stripping shovel. When assembled, this giant earthmover – Bucyrus Erie's Model 3850-B – will tower 20 stories above the ground and will be capable of picking up 115 cu yd of overburden in a single bite. Peabody Coal Co. has two of the king-size shovels on order, the first of which will be shipped in 300 railroad cars to a Peabody mine in western Kentucky.

70% of M. A. Hanna's assets are stock holdings in Consolidation Coal Co., Hanna Mining Co. and National Steel Corp. Other assets include anthracite properties, Great Lakes and Canadian coal distribution and vessel fueling businesses and reserve coal lands in West Virginia and Ohio.

The Hanna Mining Co. has acquired the company's interests in the Iron Ore Co. of Canada and the principal activities of M. A. Hanna affiliates in the management and operation of mining shipping and dock facilities. The Empire Hanna Coal Div. in Canada will be sold to outside interests except for the vessel fueling dock at Windsor, Ontario, which was acquired Nov. 1 by North Western-Hanna Fuel Co., a Consol subsidiary. The Lake Coal Div., also acquired by Consol, will henceforth operate as the Lake Coal Div., Consolidation Coal Co. William A. Turner, formerly president of Hanna's Lake Coal Div., has been named president of Consol's new dvision. George P. Cooper and John Q. Huey will continue as vice presidents of the division.

## Largest Anthracite Order Awarded By Defense Dept.

**A contract representing the largest single order for anthracite coal in the history of the industry was awarded by the Defense Department to 16 Pennsylvania coal concerns for shipment of 485,000 tons to U.S. Army Installations in West Germany. (See photo on page 44.)**

The order, valued at $11,500,000, will add about $5,000,000 in direct mine payrolls. Shipments started last month and will continue until next June. The benefits derived from this economic stimulus are expected to extend beyond the 8-mo delivery period for years to come. Awarding of the contract is in line with the administration's balance of payments program which was aimed at reducing the spending overseas of U.S. gold dollars.

Some of the companies who will supply the anthracite are Glen Alden, Honeybrook Mines, Inc., Hudson Coal Co., Lehigh Navigation-Dodson Co., Pagnotti Coal Co., Peca Coal Co., Pompey Coal Co., Lehigh Valley Anthracite Inc. and Moffatt Coal Corp.

## FPC Tightens Gas Regulation

**The Federal Power Commission's announced new "general policy" involving several rule changes designed to tighten natural gas regulation and clean up the enormous mountain of unsolved rate cases is meeting vigorous opposition from natural gas producers and distributors.**

For one thing, the FPC has ceased granting "temporary" natural gas pipeline certificates without public hearings except in emergencies or for minor expansions of pipelines. Pipeline companies were urged to plan ahead and submit applications early enough to avoid delay in necessary construction. Coal and rail interests, while gratified by this step, had strongly urged this action as long as 3 yr ago. They had contended at that time that in no major case did a temporary certificate fail to ripen into a permanent certificate after hearing, rendering such hearing an empty, meaningless informality.

The commission is also preparing to enforce its decision made last spring to bar the use of indefinite price escalation clauses in natural gas contracts. Since not all producers chose to conform, the FPC now proposes to reject outright any contract or certificate application containing the barred clause. These clauses, notes the FPC, contribute to price instability and uncertainty, are artificial grounds for rate increases, are devoid of relationship to the price of gas or rate levels, cause damaging price repercussions throughout the industry, hurt pipeline expansion and damage the consuming public.

The Independent Petroleum Association of America, representing most of the producers, made clear that it would not take the rules change lying down. Neither will the producers themselves. In answer the commission said that it would consider all protests before making the rules change final.

Definite clauses, which permit specific price rises at specific future dates and cover increases in production or gathering taxes, will still be valid.

In another decision, the commission ruled that natural gas intended only for intrastate use is subject to federal regulation when it is mixed in a pipeline with gas for interstate use.

## Rails Announce Improvement Programs

**The Chesapeake & Ohio Railway plans to construct 23 new tracks with a capacity of 1,500 cars to serve its Presque Isle coal and ore docks at Toledo, Ohio.** This expansion program which will cost $1 million, is scheduled for completion early next year. Thirteen of the additional tracks to be installed in the middle of the yard will be directly connected to the load yard that serves C&O's new 6,000-tph-capacity coal dumper.

Another major improvement program, this one involving freight-car repairs, will be undertaken by the Baltimore & Ohio Railroad, which road has been talking merger with C&O. The program will require selective repair of accumulated unserviceable equipment and maintenance of an adequate car supply for future needs.

## AEP President Retires; Successor Named

**Philip Sporn, long-recognized world leader in the field of electrical engineering, retired Dec. 1 as president and chief executive of the American Electric Power Co., although he will continue as a director and member of the executive committee.**

The former head of the giant utility holding company, will now devote his full time and energy to the AEP System development committee—a new group created by the company. Spokesmen emphasized that this would be a major committee in the firm's operating concept.

(*Continued on p 36*)

*You're holding a winning hand all the way, with*

# REPUBLIC MINE ROOF BOLTS


. . . and here's your hole card—Republic Cupped and Embossed Roof Bolt Plates! Cupping and embossing increases plate strength so greatly that ¼" Republic Plates can replace 5/16" and even ⅜" flat plates. Reduction in shipping weight alone can mean important savings for you.

Republic Mine Roof Bolts are made in designs for every type of roof condition. There's one best suited for the strata you are working in . . . and a Republic Field Service Team will run tests at your mine to help you determine which Republic Bolt will do the best job. No obligation. Write Republic Steel Corporation, Dept. CA-2780, 1441 Republic Building, Cleveland 1, Ohio.

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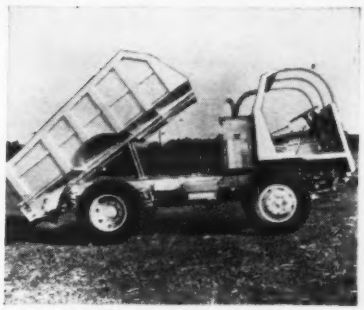
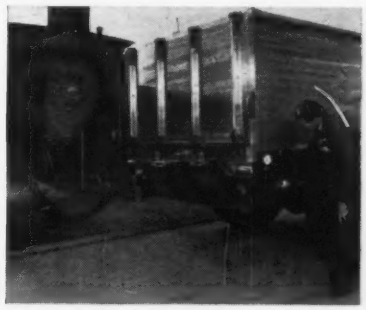
# Coal Abroad





## British Trucks, Tractors Play New Roles in Coal

**Wheeled trucks and agricultural type tractors appear to be playing an increasingly greater role in British coal mining activities of late.**

As an example, a number of mines are converting orthodox wheeled trucks (such as the one in the left illustration) and agricultural tractors for use in coal and ore mines. Mine owners find that the use of these vehicles which do not require tracks increase flexibility and lower installation costs. In most cases, the modifications are carried out by the mining company staffs.

Also contributing to this trend is a new British truck called the "Pneumarotor." One of these new vehicles is pictured at right pneumatically discharging coal through a hose to a factory boiler house. Adjustable sliding traps in the truck floor allow the coal to enter a full-width hopper beneath. From there it passes through a rotary feeder valve. The truck's capacity is about 13 cu yd and the typical discharge rate is 10 long tons an hour through 50 ft of hose.

## Germans Transform Coal Into Smokeless Fuel

**A process developed by the German Mining Association for transforming coal into a smokeless fuel may again open up to coal the country's home-heating market.** The new procedure is said to be both cheap and simple.

The coal is first dried, then made water repellent by the addition of oil and finally is briquetted with the help of thickened sulfite lye. After being so treated, the coal can be burned in the household stove, central heating boiler or even in an open chimney without producing smoke or soot. An additional advantage is that briquettes maintain their shape even when exposed to humidity.

## Energy Coordination Plan Opposed By Six

**A first attempt at European energy coordination through a coal import plan with quotas and duties was given a cold reception by the Council of Ministers of the Six at a meeting in Luxembourg held in late October.**

The plan, drawn up by the High Authority of the European Coal & Steel Community, with approval of the Common Market Commission, called for quotas on coal imports from outside the six-nation community and a high, community-wide duty on any imports above these quotas.

Representatives of all countries except Germany opposed the plan. Especially vehement were Italy, the Netherlands and Luxembourg, all of which have little coal of their own. Opponents said that a coal import plan without a parallel control of other energy imports would only serve to protect community coal at an artificially high price level while fuel oil prices would be left free to drop even lower. Moreover, to be meaningful, they pointed out, the quotas would have to be lower than present imports and governments would not be likely to permit quotas set below the previous year's import level.

The Council asked the High Authority committee to prepare a report on the feasibility of simultaneous projects to protect community coal from foreign coal imports and to protect community coal from oil. The committee was also asked to examine the possibility of a follow-up to the High Authority's coal import plan.

# Overseas Flashes

**JAPAN**—The Japanese Government may resort to a tariff hike for crude-oil imports as one means of financing its coal-industry modernization program announced several months ago. The current tariff rate of 6% would be raised to 10%

*(Continued on p 46)*

# People in Coal

## Glen Alden Fills Top Post

**WILLIAM BELLANO,** extensively-experienced minerals man, has been elevated to president, Glen Alden Coal Co. and Hudson Coal Co., divisions of Glen Alden Corp. The former executive vice president of operations was also elected a director of the corporation.

Mr. Bellano joined Glen Alden Coal Co. in January of this year following 25 yr experience in the mineral industries serving in the capacities of operations, engineering, marketing and general administration engaged in the coal mining, metals and nonmetallic fields in the United States, Mexico and South America. He has been president, Gulf Sulphur Co. and vice president, engineering, Int'l. Minerals & Chemical Corp.

A native of the West Side section of Scranton, Pa., Mr. Bellano attended Girard College in Philadelphia and is a graduate of Penn State University with a degree in mining engineering. Recently he purchased a home in Kingston, Pa., where he now resides with his wife and two children.

A member of the American Institute of Mining, Metallurgical and Petroleum Engineers, Mr. Bellano is also a member of the Canadian Institute of Mining and Metallurgical Engineers and the Mining Club of New York City. Furthermore, he is an executive reservist with the Interior Department's Office of Minerals Mobilization.

On Nov. 6 **James N. Sherwin** was elected vice president of **Consolidation Coal Co.** He had been vice president and a director of The M. A. Hanna Co. from which posts he recently resigned. During his association with Hanna, which started in 1933 upon his graduation from Princeton University, he occupied various positions in the sales and lake departments and ultimately became vice president. Mr. Sherwin will continue to have his office in the Leader Bldg. in Cleveland, Ohio.

**Robert L. Croak** has joined the **United Electric Coal Cos.** as assistant to the vice president-sales. With headquarters in the company's St. Louis office, he will coordinate his activities in conjunction with the general sales offices in Chicago. Since graduation from the University of Missouri in 1949 as a marketing major, Mr. Croak has been active in coal sales in the St. Louis and surrounding market area.

**J. William Pettipas** fills the new post of vice president-operations of **C. H. Sprague & Son Co.,** coal and fuel-oil distributors. He was also named a director of the company. Mr. Pettipas joined Sprague's operating department in 1923 and progressed through the many phases of operations on the firm's tidewater docks to become, in 1943, general dock superintendent of all Sprague's tidewater coal terminals in New England and New York. In this position he has been responsible for the development of a new coal terminal at Portsmouth, N. H., in 1948. In 1960 he became vice president and a director of Atlantic Terminal Sales Corp., a Sprague affiliate in Newington, N. H.

**Harry W. Bradbury,** president, **Glen Alden Coal Co.**—the world's largest anthracite producing company—resigned from that post Oct. 31. Glen Alden has retained Mr. Bradbury's services in the capacity of consultant to the various presidents of the corporation's divisional operations. Following a month's vacation, he will assume his new duties at his Glen Alden offices in New York City. Mr. Bradbury had served as president since July, 1958, and before that had been executive vice president in charge of coal. At one time a federal coal-mine inspector, he has also held positions with Moffat Coal Co. and Lehigh Valley Industries, Inc.

**K. K. Kincell,** general superintendent, **Mountaineer Coal Co., Div. of Consol,** recently participated as a U. S. representative at the University of Pittsburgh's 27th Session of Management Problems for Executives. Mr. Kincell had been division superintendent in charge of Consol No. 93, Jamison No. 9 and Loveridge mines of Consolidation Coal Co. Div. of Pittsburgh Consolidation Coal Co. Before that he held superintendent posts at the Consol No. 93 and Loveridge mines.

## Associations

**Central Pennsylvania Open Pit Mining Association** has elected A. R. Davidson, vice president. Mr. Davidson, president, Maple Hill Coal Co., fills the post vacated by the death of Robert Bailey who had been elected along with other officers Sept. 18 (*Coal Age,* November, 1961, p 30).

Layton DeLauter, DeLauter Coal Co., moves up from vice president to president, **Ohio Reclamation Association.** R. C. Whitaker, U. S. Coal Co., succeeds Mr. DeLauter as vice president, and Larry Cook was reelected executive vice president. Also reelected were Robert J. Kinnard, executive secretary, and James C. Robb, secretary-treasurer. New board members are Roy Friel, Friel Coal Co., and Wylie Fritts, Adams Mills Coal Co. Board members reelected include Charles Atha, Blue Crystal Mines; Mr. DeLauter; William V. Hartman, Peabody Coal Co.; A. D. Henry, North American Coal Corp.; R. L. Ireland, Consolidation Coal Co.; Richard James, James Brothers Coal Co.; C. H. Minich, East Fairfield Coal Co.; Miller Munjas, Truck Coal Co.; John W. Taylor, J. T. Coal Co.; and Mr. Whitaker.

**The Operators' Association of the Williamson Field** held its 47th annual meeting Oct. 30 at Williamson, W. Va. The following officers were elected: president—I. J. Richardson, president, Harman Mining Corp.; vice president—R. D. Jones, general manager, Kentland-Elkhorn Coal Corp.; treasurer—Laurence E. Tierney Jr., president, Eastern Coal Corp.; executive secretary—Joseph J. Ardigo. Elected to the board of di-

(*Continued on p 40*)

# 10 YARD DRAGLINE / 45 SECOND CYCLES = PRODUCTION +

The headline tells only part of the impressive production story at this Pennsylvania coal stripping operation. Even though it weighs well over 300 tons, this Marion 183-M diesel dragline can move quickly from one location to another to keep nonproductive time at a minimum. The unit's basic dependability and an exceptional 90% bucket fill factor are equally strong contributors to the big output being realized on this coal stripping property. Our mining consultants will be happy to discuss how the 183-M and similar size excavators are helping other owners in their continuing search for better stripping economies.

**MARION POWER SHOVEL COMPANY • MARION, OHIO**

A Division of Universal Marion Corporation

Mr. Sporn will be particularly concerned with engineering and technological developments. Having joined AEP in 1920, he has been head of the parent and all subsidiary companies since 1947.

Donald C. Cook, formerly vice president, has been chosen to succeed Mr. Sporn. Mr. Cook's first post with AEP in 1953 was vice president and assistant to the president. From 1935 to 1947 he served with the staff of the Securities and Exchange Commission, the last 7 yr in the public utilities division. In 1949 he was named a commissioner on the SEC by President Truman, rising a year later to vice chairman and in 1952 to chairman.

## Soviets Push Oil Exports

**A stepup in pressure from cut-price Soviet oil exports is indicated in a Bureau of Mines report on growth characteristics of the USSR tanker fleet.** Now the world's second largest crude-oil producer, Russia in the past 10 yr increased its tanker fleet by 108 vessels, representing 90% of its present total tonnage and plans a further substantial expansion by 1965, according to the Bureau report.

One consequence the United States is likely to suffer as an indirect result of this buildup would be pressure from oil-producing countries losing markets to Russia to take more of their oil. The U. S., already overburdened with oil surpluses has been wrestling for some time now with its oil import control program. In late October Interior Secretary Stewart L. Udall recommended a reduction in oil imports. Although no details were given at that time, he said that the proposed changes were also designed to clarify certain ambiguous parts of the mandatory program to control oil imports.

R. E. L. Hall, NCA general counsel and director of government relations, warned recently that Russia is pushing an oil export program "aimed at destroying the flexibility and dependability of the free world's fuels troika—the coal, natural gas and oil industries." He said that in addition to feeling the serious economic impact of the Red moves, non-Cummunist countries face a threat to their security in the form of a dangerous energy gap.

## Pollution Controls Tightened in W. Va.

**The State of West Virginia is following Pennsylvania's lead in tightening up controls of strip-mining operations inside her borders.**

State Mines Director Leonard J. Timms and State Natural Resources Director Warden M. Lane released a series of new regulations designed to prevent stream pollution by the open pit mines. The regulations provide, among other things, that surface and ground water must be diverted from the mine pit, where practicable, to reduce the flow of black water through the open working. If water does get into the pit, it must be handled in a manner which will minimize the formation and discharge of acid mine drainage to streams. The new regulations became effective Dec. 1.

## Utilities Would Assist Federal Hydro Plants

**An offer by 14 Midwest utilities to provide power for the Missouri River basin is the latest in a recent series of moves by the investor-owned utilities aimed at effecting a working agreement with public power interests.** The 14 power concerns which would supply customers of Federal hydroelectric plants with power during periods of low production, wished to show that they could provide the needed power and that, therefore, Federal construction of new generating plants or transmission lines would not be needed.

Included in recent months have been offers by 11 utilities in seven Southwestern and Middle Southern states to exchange seasonal surpluses of power with the Tennessee Valley Authority.

In mid-September, the Edison Electric Institute announced plans for an $8 billion 10-yr interconnection program designed to provide a completely interconnected national power network and avoid duplication with Federal lines.

# Utilization

**Ground was broken in late October at Glenrock, Wyo., for a new commercial fertilizer plant which will process lignite for humic acid, a valuable fertilizer component.** Thick pads of lignite—or leonardite, as it is called in the fertilizer industry—lie 25 mi north of Glenrock. American Humates Inc. has leased 5,000 acres of state and federal land in that area to acquire the needed leonardite for processing in its new plant. Scheduled for completion by mid-February, 1962, the plant is expected to produce 12,000 tons of fertilizer annually.

**Consolidated Edison Co. of New York has awarded Combustion Engineering Inc. a contract for what is described as the largest steam-generating unit ever ordered.** Designed to burn pulverized coal, the twin-furnace unit has a capacity of 350 tph, or nearly 170 car-loads a day, which would generate 6.5 million lb per hr of steam. An unusual aspect of the design allows one furance to be shut down permitting the turbine generator to be operated at half of its full power capacity.

### Bituminous Output

| YEAR TO DATE | PRODUCTION |
|---|---|
| Nov. 11, 1961 | 338,524,000 |
| Nov. 12, 1960 | 363,071,000 |

1961 output 6.8% behind 1960.

| WEEK ENDING | PRODUCTION |
|---|---|
| Nov. 11, 1961 | 8,625,000 |
| Nov. 12, 1960 | 7,513,000 |

### Anthracite Output

| YEAR TO DATE | PRODUCTION |
|---|---|
| Nov. 11, 1961 | 15,461,000 |
| Nov. 12, 1960 | 16,041,000 |

1961 output 3.6% behind 1960.

| WEEK ENDING | PRODUCTION |
|---|---|
| Nov. 11, 1961 | 358,000 |
| Nov. 12,, 1960 | 399,000 |

# Mines, Companies

**Delta Coal Corp., an Ayrshire Collieries Corp. subsidiary, began construction of an open pit mine in West Central Illinois which will have an annual production capacity of 700,000 tons.** Located about 75 mi southwest of Peoria, the mine will have both direct rail and water access to Chicago. Full operation is scheduled for early 1963.

**The nation's highest strip mine situated at an 8,000-ft elevation in the mountains of north central Colorado has been purchased by the Pittsburg & Midway Coal Mining Co.** Acquisition of the Edna mine, which has been operated since 1945 by Edna Coal Co., will extend the life of P&M's mining activities in coal 30 or more yr. Lowering the coal from the mine to the preparation plant is handled by a 2,400-ft belt conveyor which declines over 700 ft.

# Competition

**One aim of the first atomic blast intended to seek peaceful uses of nuclear energy will be to learn whether the heat trapped from the underground blast can be used to make steam for the generation of electricity.** The Atomic Energy Commission estimated that if all the heat from the $5.5 million blast could be recovered, it would produce 6.25 million kwhr of electricity.

Since the electric utility industry last year could produce 1 kwhr from .88 lb of coal, the AEC's experiment would produce—at maximum efficiency—the electricity that could be generated by 2,751 tons of coal at a cost of $17,221, since coal "as consumed" cost the utilities an average of $6.26 a ton last year.

# This man...
# is running this locomotive

There is no one in the locomotive. The man in the picture can speed up, slow down, stop or reverse this train, *whether he is riding the locomotive or walking, or standing on the ground.* Both he and the locomotive are equipped with a new Union Switch & Signal remote control system for industrial switching locomotives. Because the operator always can be at the best vantage point, blind operations are eliminated and cars are spotted for loading, unloading or dumping more efficiently. This man can put a car *precisely* where he wants it.

You can minimize the hazards involved as freight moves around your plant with this unique remote control system. If you have a special problem such as moving cars into a thawing pit or under a loading chute, use a centrally located console control unit so one man has complete control over the entire operation.

Look over your in-plant locomotive operation and see if it couldn't be made safer and more efficient if the man running the train could always see what he was doing. Check the coupon for our illustrated Bulletin 187 on how our remote control systems can work for you.

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**Company** _____

**Address** _____

**City** _____ **Zone** ____ **State** _____

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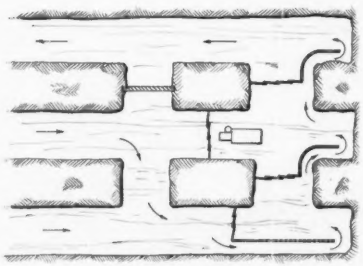
# Current Coal Patents

**Oliver S. North**
Patent Research and Abstracting
Arlington, Va.

**Articulated self-tracking conveying apparatus, W. N. Poundstone (assigned to Consolidation Coal Co., Pittsburgh, Pa.), Oct. 10, 1961.** Design for an articulated conveying means for moving coal continuously from a continuous-mining machine to a relatively fixed, straight-line conveyor. A plurality of interconnected articulated conveyor sections are provided with a single drive mechanism. These sections are operable in either narrow or wide passageways, optionally in association with an extensible conveyor. No. 3,003,612.

**Impact crusher, J. W. Leonard (assigned to U.S. Steel Corp, Pittsburgh, Pa.), Oct. 10, 1961.** Design for an impact type coal crusher which includes a tapered rotor for throwing particles against impact plates at velocities varying with the initial particle size, thereby lessening the tendency to pulverize small particles to sizes finer than are desired. No. 3,003,708.



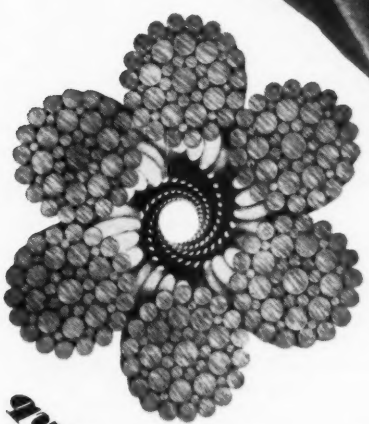
**Mine fly pad, I. Hargis, Oct. 31, 1961.** Design for a mine air current deflecting brattice assembly which is sufficiently flexible to permit free flow of mining traffic yet without interference of air flow. The brattice is a dielectric comprising a plurality of overlapping curtain members which hang from the mine roof in substantial sealing relation thereto. The assembly is durable to withstand continued use over extended periods of time, and it can be readily installed and removed within the confines of a mine. No. 3,006-267.

**Telescopic tubular pit props, C. M. Frye (assigned to Dowty Mining Equipment Ltd., Aschwich, Tewkesbury, England), Sept. 26, 1961.** Design for a telescoping mine prop of relatively inexpensive construction, being made from drawn steel tubing and so formed that it is not necessary to maintain perfect straightness and roundness in the cylinders. No. 3,001,808.

**Automatic cycling control for continuous miners, J. R. Bouillé (assigned to Joy Mfg. Co., Pittsburgh, Pa.), Oct. 3, 1961.** Design for an improved automatic cycling control mechanism for the sumping, swinging, retracting and lowering movements of the attacking and disintegrating head of a continuous miner. A fluid-actuated vent-control valve is held open by pressure in the swing cylinder as a result of the weight of the head which causes gravity swing of the head towards its lowered position; this pressure is dissipated when the head assumes its lowered position so that the control valve automatically closes. No. 3,002,732.

**Means for swinging freely suspended roller assemblies, R. F. Lo Presti (assigned to Goodman Mfg. Co., Chicago, Ill.), Oct. 3, 1961.** Design for a belt-training troughing idler assembly having wing rollers pivoted about their inner ends and free to swing into a belt-training position at their outer ends means for instantly swinging the rollers upon reversal of belt travel. The belt imparts a series of jolts to the roller assembly to

*We put a lot of work into it — You get a lot of work out of it*



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John A. Roebling's Sons Division
The Colorado Fuel and Iron Corporation.

relocate it automatically in response to reversal of belt travel. No. 3,002,606.

**Belt-training trougher-idler assembly for endless belt conveyeors, R. F. Lo Presti (assigned to Goodman Mfg. Co., Chicago, Ill.), Oct. 17, 1961.** An improved troughing roller and idler assembly capable of exerting a centering bias on the load-carrying reach of a belt conveyor consists of (1) a troughing roller assembly yieldably connected between a pair of spaced supports, (2) a center roller of the assembly offset downstream from the yieldable connection in the direction of belt travel, and (3) a pair of downwardly and inwardly inclined troughing rollers located one on each side of the center roller. No. 3,004,652.

**Continuous mining machine having vertical cutting rotors, F. Doxey (assigned to Dominion Coal Co. Ltd., Sydney, Nova Scotia, Canada), Oct. 31, 1961.** Design for a longwall mining machine which includes a combination of undercutting means, side shearing means, and separately operable power-operated top-wedging means. In operation, the machine attacks the vein to undercut it and at the same time to shear at the side and above the undercut to the desired height of the seam to form a block which is clear of the seam underneath, at the face and two sides, and is only held at the roof and front. Part of the block is then wedged free from the top. The wedging action causes the block to break up into pieces of a convenient size which can be readily conveyed out of the cutting area. No. 3,006,624.



## Preparation Facilities

**Eastern Gas & Fuel Associates, Kopperston Mine, Kopperston, W. Va.**—Contract closed with Deister Concentrator Co., Inc., for six Concenco "77" coal-washing tables, six Concenco two-way splitters and one Concenco Model CCF feed distributor to handle 3/16x48 coal.

**Eastern Gas & Fuel Associates, Stotesbury No. 10 tipple, Helen, Raleigh County, W. Va.**—Contract closed with Fuel Process Co. for froth-flotation plant addition to the existing air cleaning plant to handle minus 14-mesh Pocahontas No. 4 seam coal at 20 tph.

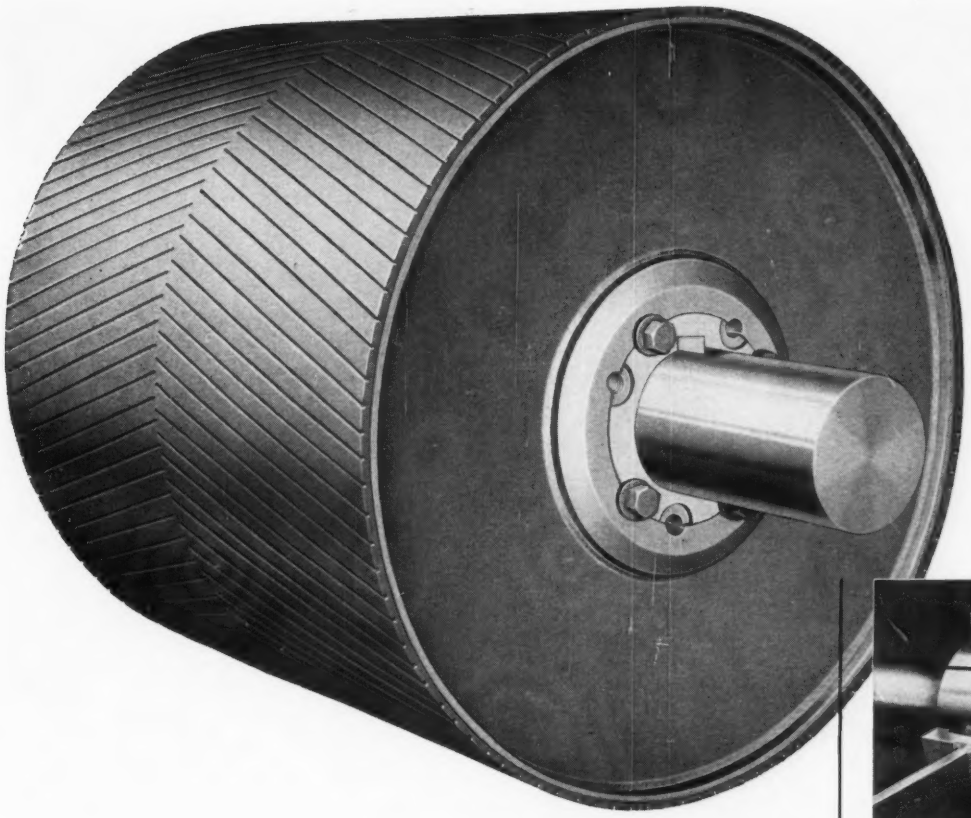
**Page Coal & Coke Co., Buckeye No. 3 Mine, Stephenson, W. Va.** – Purchase authority issued to The Daniels Co. covering a second DMS dense-media precision coal-washing facility including dense-media washing equipment and accessories.

**Armco Steel Corp., Montcoal, W. Va.**—Contract closed with Eimco Corp. for one 90-ft-dia thickener mechanism and two 11-ft 6-in-dia x 16-ft face drum filters with roller discharges. The equipment, which was sold through the McNally Pittsburg Mfg. Corp., will remove 10 tons of high ash refuse in froth-flotation tailings water.

## People in Coal (*Cont'd from p 34*)

rectors were: L. E. Woods, president, Crystal Block Coal & Coke Co.; E. M. Bane, president, D. J. B. Collieries, Inc.; C. W. French, president, Peter White Coal Co.; C. T. Dahlin, general manager, Princess Coals, Inc.; M. K. Reed, president, By-Product Coal Co.; R. D. Squibb, executive vice president, Massey Coal Mining Co.; and W. W. Walker, chairman of the board, Harman Mining Corp.

**The Wyoming Development Association,** successor of the Wyoming Reclamation Association, has reelected State Rep. Marlin T. Kurtz as president. Victor Bauer, Pacific Power & Light Co., was named first vice president and Russ Beamer, secretary, Wyoming Mining Association, was elected second vice president.



# AMERICA'S NO. 1 STEEL CONVEYOR PULLEY!

There are more Taper-Lock Steel Conveyor Pulleys than any other operating on big jobs. Why? Simply because of the dependable performance they deliver under the toughest conditions.

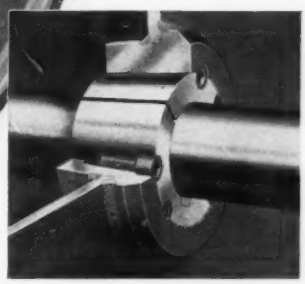
The rims, discs and hubs are *steel* — and they are fused together into jointless drum construction for (1) maximum strength with minimum weight, (2) exclusion of dirt, water and steam, (3) terrific shock resistance. Every weld is made by the submerged arc process giving deep penetration and exceptional strength. Rims are accurately die formed in the smaller diameters and rolled in the larger diameters. Pulleys with 26″ and wider faces have interior discs that add to the trueness, rigidity and strength of the rims.

Dodge offers the world's biggest range of stock sizes. Diameters from 6 inches to 8 feet — all face widths, crowned or flat. Standard or special rubber lagging available. Ask your local Dodge Distributor — or write us for a technical bulletin.

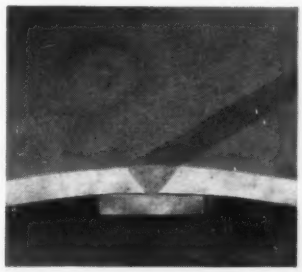
Dodge Manufacturing Corporation, 3000 Union Street, Mishawaka, Indiana

*The Products with the Pluses...* **DODGE** *of Mishawaka, Ind.*

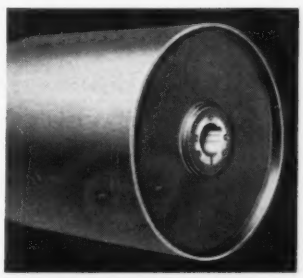
**CALL THE TRANSMISSIONEER,** your local Dodge Distributor. Look under "Dodge Transmissioneer" in the white pages of your phone book. Factory trained by Dodge, he can give you valuable assistance on new cost-saving methods.



No "walking" on the shaft with Taper-Lock. Full length contact of hub. Holds under heavy loads and shock. Easy on — easy off.



Patented Back-up Bars give full rim strength through 100% weld penetration. Diametrically opposed bars insure balance.



Jointless construction creates a drum fully sealed against conveyed materials of all kinds as well as dirt, water and steam.

16,000 ft. of neoprene-covered belting hauls jagged slate and coal to rail points at 250-300 ft./min. Installed in September '58, belt is specially designed for underground service.

# LIGHTWEIGHT CONVEYOR BELT THRIVES ON HEAVY-DUTY SERVICE!

Still "like new"—despite over three years of brutal underground service! That's the latest report from Royalty Smokeless Coal Co.'s, Medo No. 2 Mine, Clifftop, W. Va., following a recent inspection of the belt shown above. And here's the reason: covers of tough, resilient *neoprene* synthetic rubber, coupled with a unique, lightweight, all-synthetic carcass.

Neoprene's reputation for prolonging belt life is based on its resistance to conditions that pound the life out of ordinary belting. Flexible and fire-resistant, neoprene also defies abrasion and impact, protects belt carcass from oil and grease, moisture and mildew. And its high coefficient of friction minimizes spillage, slippage and "run out" at loading points—delivers maximum loads over the head pulley.

Next time *you* order belting, make sure it has a cover of rugged, longer lasting Du Pont neoprene. No other material has been so thoroughly proven in severe mining service above ground and below . . . as cable jacketing, conveyor belting and hose. For more examples to show how neoprene-covered belts are serving industry, write: E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department CA-12, Wilmington 98, Delaware.

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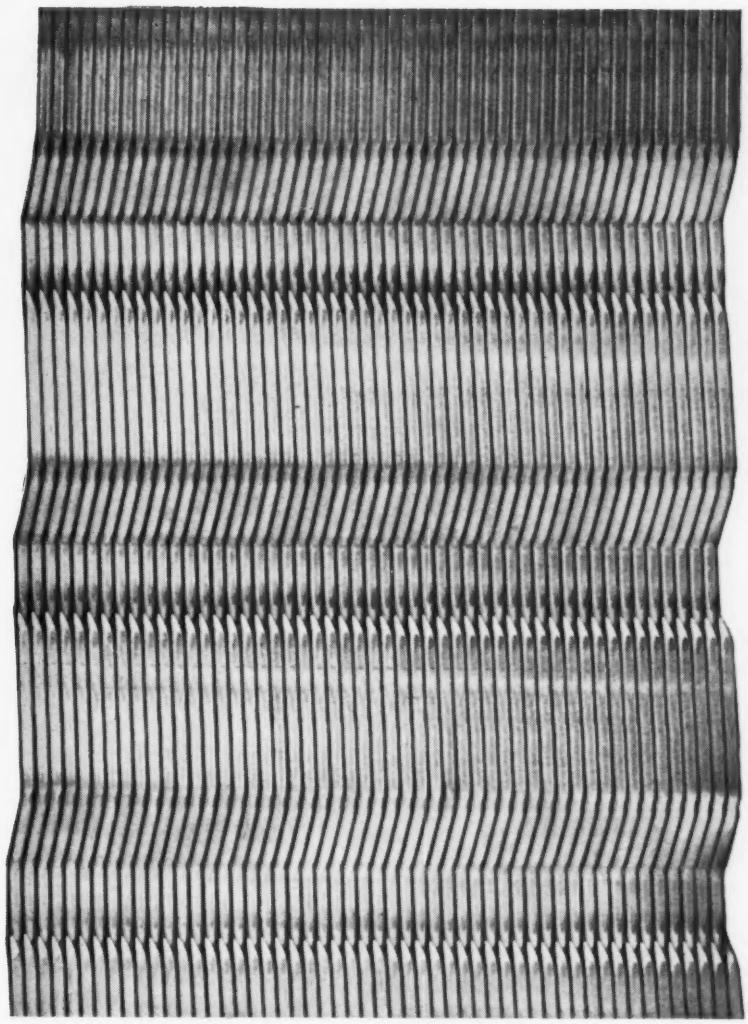
**NEOPRENE**
SYNTHETIC RUBBER

**Better Things for Better Living . . . *through Chemistry***



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## MEDIA WASTAGE
## with Hendrick Cascade Wedge Wire Screen

Whether you're screening coal, iron ore or gravel, you can't beat Hendrick Wedge Wire Cascade screens for dewatering efficiency. Cascade's unique "step" construction eliminates flooding caused by overloads... increases the weight of solids processed as well as the amount of water in screen under flow. Wavy wedge wire breaks up the flow layer and causes a tumbling action that permits far greater throughput. As a result you can sharply increase draining capacity and media recovery. Hendrick Cascade screens can be mounted on any equipment presently using profile type screens. They're available with openings from ¼ to 1½ m.m. in stainless steel. Send in the coupon for more information.

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Hendrick Wedge Wire Screens • Architectural Grilles • Mitco Open Steel Flooring • Shur-Site Treads • Armorgrids • Hendrick Hydro Dehazers

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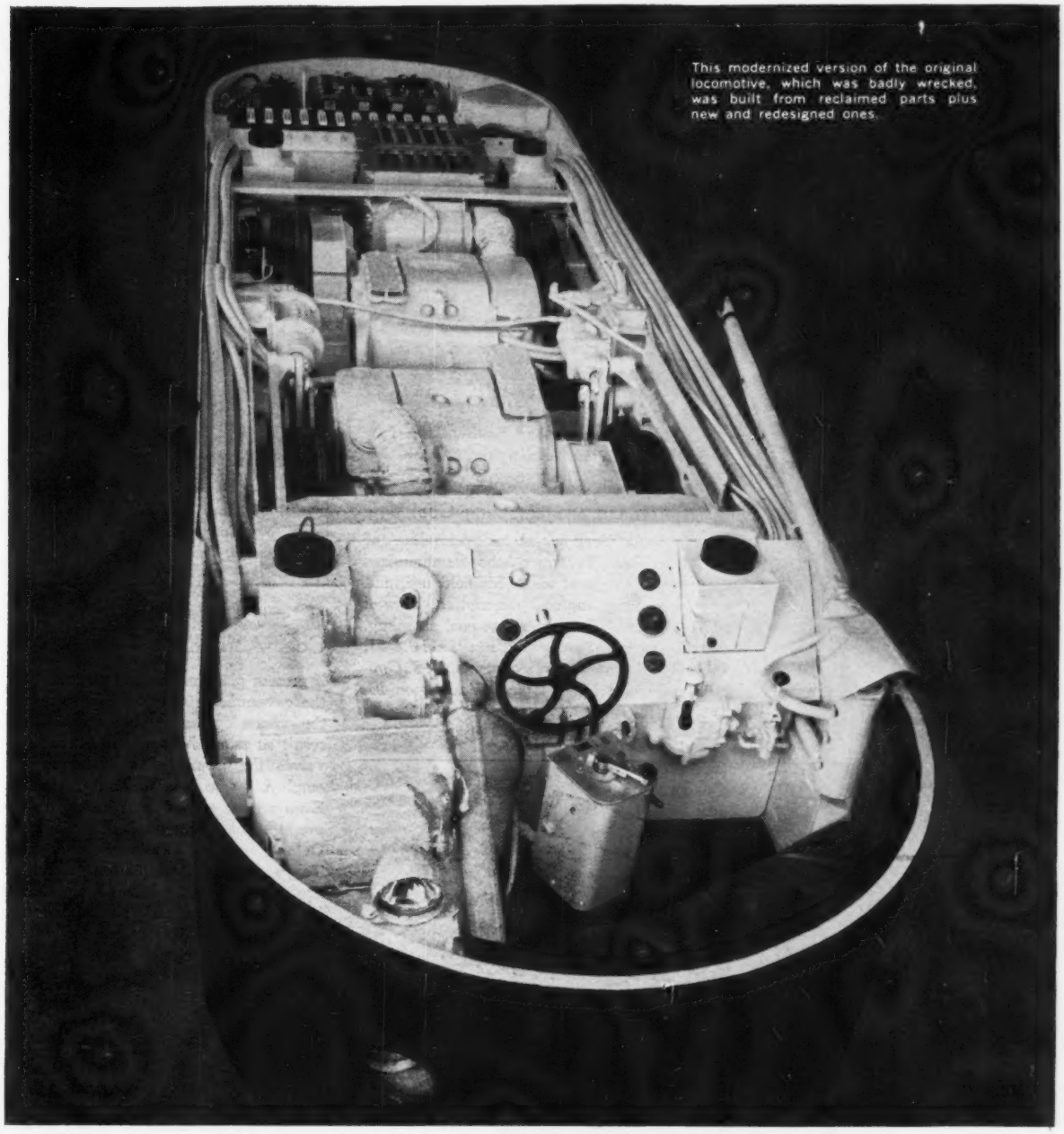
**THE FIRST CARGO** of more than 485,000 tons of anthracite bound for United States army installations in West Germany, being loaded aboard the freighter "World Conqueror," is witnessed by anthracite and railroad officials. Shipments scheduled through June, 1962, will be handled by the Foreston Coal Export Co. of New York.

The Defense Department contracts, awarded to 16 Pennsylvania coal concerns, follow months of work by Senator Joseph S. Clark Jr. and Congressman Daniel J. Flood of Luzerne County, who urged that the previous policy of purchasing coal from European sources be reversed. (For story, see p 30.)



This modernized version of the original locomotive, which was badly wrecked, was built from reclaimed parts plus new and redesigned ones.

# NATIONAL'S COMPLETE REBUILDING SERVICE MODERNIZES MINE LOCOMOTIVE

This 24-ton locomotive was delivered to National's plant completely wrecked. Redesign and complete rebuild by National to new equipment standards included bumpers, air brakes, contactors, low voltage control system and other major modifications. National not only rebuilds mobile underground mining equipment but incorporates newest developments. Motor windings, for instance, have the latest and best grade insulation tailored by National to increase the work the whole locomotive can do. For unmatched service in mining machinery repairs, check your National field engineer or contact National Electric Coil... Bluefield, W. Va., or Columbus, Ohio... or National Electric Service Corporation . . . Harlan, Kentucky.

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# New Books

## Mine Ventilation

**Mine Ventilation and Air Conditioning,** by Howard L. Hartman. A comprehensive, up-to-date and well presented treatment of mine ventilation, including quality control, quantity control and temperature-humidity control. Starting with the basic laws of gases, the author covers in detail such topics as air measurements, flow of air, design of networks and the design of temperature-humidity control systems. Solutions of example problems illustrate the practical application of ventilation theory. Each topic is presented independently, enabling the reader to adapt the book to his immediate requirements. This treatment also gives the college instructor maximum flexibility in developing his course. *398 pp. 6x9-in; cloth. The Ronald Press Co., New York 10, N. Y.*

## Air Pollution

**Proceeding of the International Clean Air Conference** contains 78 papers from 17 countries which were presented at the clean air conference in London in October, 1959. The wide range of problems discussed and the number of different countries represented by the contributors make this one of the most comprehensive surveys ever published. All papers are in English reviews and discussions are included in the book. *283 pp. 7x9¾-in; cloth. $4.75, National Society for Clean Air, Field House, Breams Building, London, E. C. 4, England.*

## ASTM Standards

**Supplements to Book of ASTM Standards.** The 1960 supplements bring up to date the corresponding 10 parts of the 1958 Book of Standards and 1959 Supplement. *$4 each part, $40 per set. American Society for Testing Materials, 1916 Race St., Philadelphia, Pa.*

## Describing and Sampling Coal

**Field Description and Sampling of Coal Beds,** by James Schopf summarizes descriptive coal terms for field use, and procedures for coal description, as well provides helpful notes on coal sampling. *Geological Survey Bulletin 1111B. $1, Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.*

## Coming Meetings

Coal Mining Institute of America, 75th Annual Meeting, Dec. 14-15, 1961 — Penn-Sheraton Hotel, Pittsburgh, Pa.

Joint Meeting; Minnesota Section, AIME Annual Meeting and 23rd Annual Meeting Symposium, University of Minnesota, Jan. 15-17, 1962—Duluth, Minn.

AIME Annual Meeting, Feb. 18-22, 1962 — Statler-Hilton Hotel, New York, N. Y.

Workshop and Symposium, University of Arizona and Stanford University, March 26-30, 1962—Stanford University, Palo Alto, Calif. Program will cover the use of electronic computers in the minerals industry.

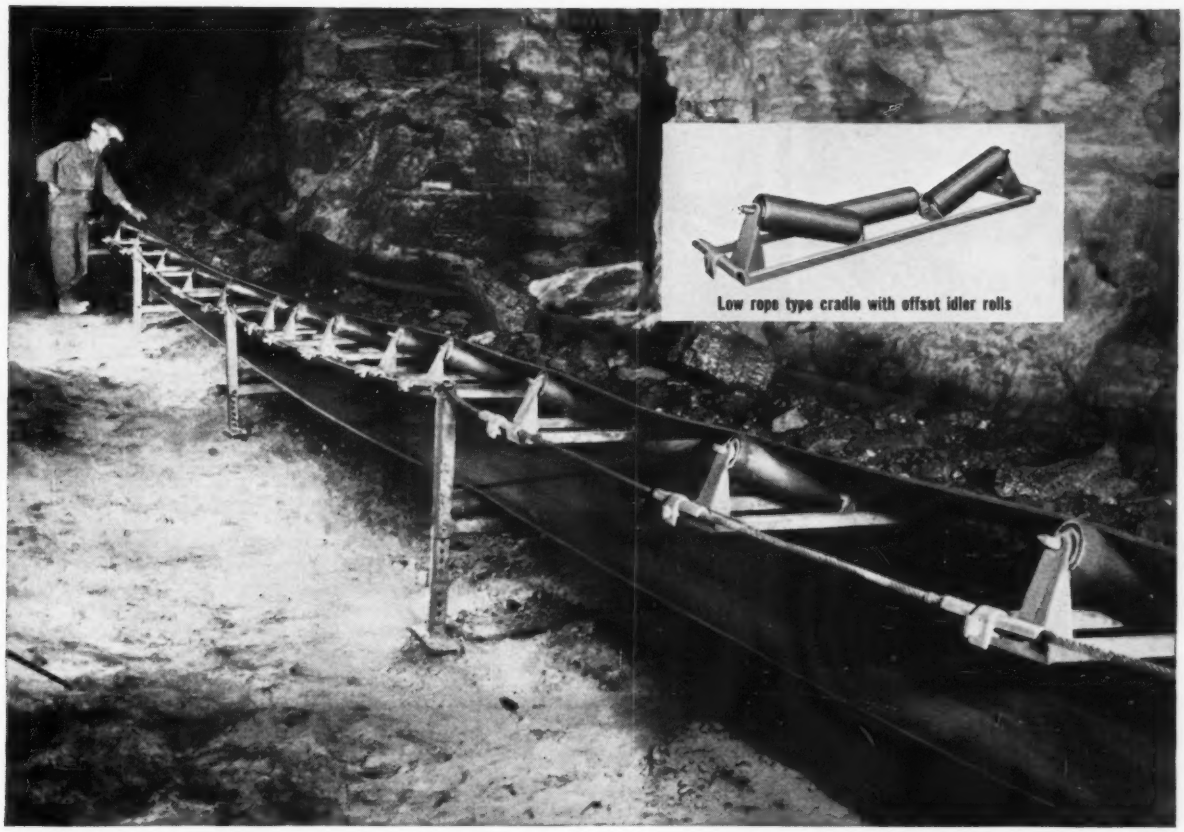
1962 Coal Convention, American Mining Congress, May 6-9, 1962—Pittsburgh, Pa.

## Coal Abroad (*Cont'd from p 33*)

if present plans materialize. Another step the government is considering to resolve the unemployment problem which will result as mines become mechanized, involves the award of cash bonuses to employers who hire the laid-off miners. Even now unemployment in Japan's depressed coal industry is heightening. Last October some 1,250 miners converged in Tokyo after a 2-wk 300-mi march to protest layoffs and demand government help for the dismissed. The labor ministry estimates 70,000 miners of a total 270,000 face discharge.

**GREAT BRITAIN** – The Drakelow B power station near Burton on Trent, England, officially opened Oct. 23 and was connected to Britain's supergrid. The 480-mw, $64-million station forms the second part of the Central Electricity Generating Board scheme for a 2,000-mw complex on the Drakelow site to exploit low-quality coal from the East Midland coalfield. Drakelow C – third and final stage—is slated for completion in 1966.

**SOUTH VIETNAM** – South Vietnam is proceeding with plans to create the nucleus of a chemical industry using local anthracite coal as major raw material. The chemical center is to be located at Nong-Son where coal is being mined with the technical assistance of the Paul Weir Co. of Chicago. France has pledged a 15-yr export credit of over $14 million to finance industrial installations for the initial phase of the chemical complex which will provide a base for several industries using chemical by-products.




# Jeffrey repeat orders prove conveyor production performance

Almost unbelievable performance is demanded of most mine equipment, and belt conveyors are no exception. These are required to function under most adverse conditions. Few can take the punishment long enough to win the approval of alert, progressive mine operators. Jeffrey wire-rope type conveyors can. Proof of that easily can be seen in repeat orders placed by leading coal producers. The Clinchfield Coal Company, Dante, Virginia, is one of these. Ten miles of Jeffrey wire-rope type belt conveyors have been purchased for their Moss #3 Mine.

| Year | Units | Total Feet |
|---|---|---|
| '58 | 6 | 8,000 |
| '59 | 4 | 9,500 |
| '60 | 4 | 13,000 |
| '61 | 8 | 22,500 |

These belt conveyors are about equally divided between 36-inch and 48-inch widths.

Jeffrey wire-rope type conveyors last longer because the wire rope provides a spring-like action to cushion the loaded belt as it rides over the idlers. Permaseal® Idlers are sealed to keep out dust and dirt...give years of maintenance-free operation.

For complete information about Jeffrey wire-rope type conveyors, write for Catalog 970. The Jeffrey Manufacturing Company, 912 North Fourth Street, Columbus 16, Ohio.

*If it's conveyed, processed or mined, it's a job for Jeffrey.*

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## with Primacord M/S Connectors for accurate dependable millisecond surface-delay blasting

You can enjoy the advantages of delay blasting without the hazards of sensitive delays in the holes. In open pit mines, quarries and construction blasting – medium to large diameter holes – use the Primacord System of initiation with Primacord M/S Connectors tied into the Primacord trunklines.

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4. Primacord has a minimum initiating strength of a blasting cap at all points.

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1911 • FIFTY YEARS OF SERVICE TO COAL MINING • 1961

Devoted to the Operating, Technical and Business Problems of
The Coal-Mining Industry

COAL AGE

DECEMBER, 1961

IVAN A. GIVEN, EDITOR

# One of Progress

**No question but what more tonnage would have been most helpful to the bituminous industry in 1961.** It certainly would have saved several of the mines and companies that had to give up, and would have meant more jobs and more earnings for employees, as well as firmer prices and a better profit position for the employers.

**The preceding adds up to a sizeable list of adverse or unsettling factors resulting from the continued low level of demand.** However, that demand was strengthening at the end of the year, and bituminous, along with anthracite, could take satisfaction in how well it did in spite of the handicaps imposed by a reduced rate of output. Investment in new plant and equipment for raising quality and efficiency suffered, as did bituminous safety—the latter repeating the pattern of other low-demand eras. But there was another healthy increase in tons per man, helping the industry maintain a reasonable level of earnings in spite of added price pressure.

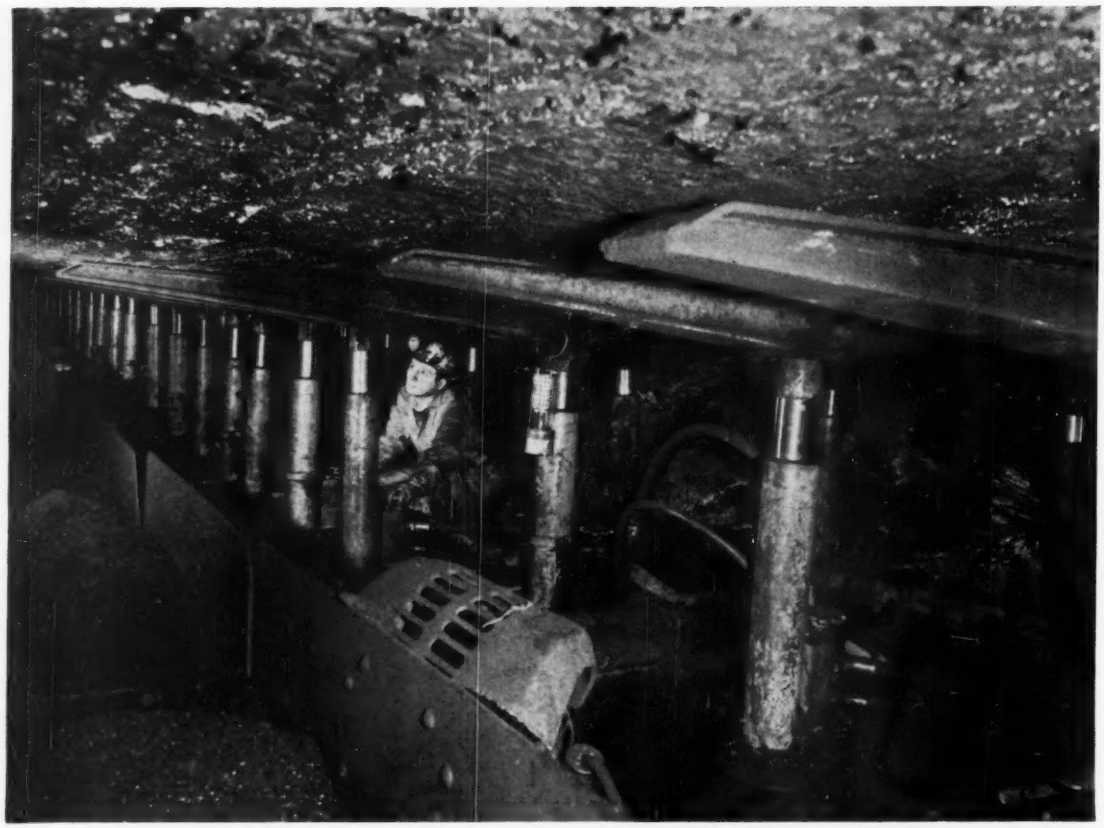
**And as the year wore on it became clearer and clearer that real growth is ahead** for bituminous in not only the far-distant future but the relatively near. Consider, for example, four 1961 forecasts of bituminous demand:

| | |
|---|---|
| **Coal Age,** year 1970 | 625-650,000,000 |
| **U. S. Bureau of Mines,** 1975 | 671,000,000 |
| **Texas Eastern Transmission Corp.,** 1975 | 673,000,000 |
| **Philip Sporn,** American Electric Power Corp., 1975 | 900,000,000 |

**All these opinions about the future course of bituminous demand are based on the solid conclusion that coal's competitors** of whatever type, will fall back from their present peaks as time goes on—and also on the conclusion that there will be no technological breakthroughs or "black boxes" that will seriously challenge the present energy sources and coal in particular in the future. And since demand levels such as these will not be reached overnight, it becomes obvious that the swell to these higher totals must begin in the very near future, though it will be modest at first.

**One thing that will help as much as anything else in reaching the higher tonnages of the future** will be more research and more market promotion. One of the advances of this year was the decision of the industry to take a new look at this vital phase of its operations. Though the money to make possible the program some think is necessary probably will not be forthcoming immediately, a start will have been made and a foundation erected to build on—speedily, it is to be hoped.

**With these exceptions, and with the further solid progress made in quality and cost control in 1961,** the year can be counted as one of progress in spite of the adverse effects inevitable when demand drops off.



**SELF-ADVANCING ROOF-SUPPORT SYSTEM** reduces manpower more than 50% and effectively controls the roof.

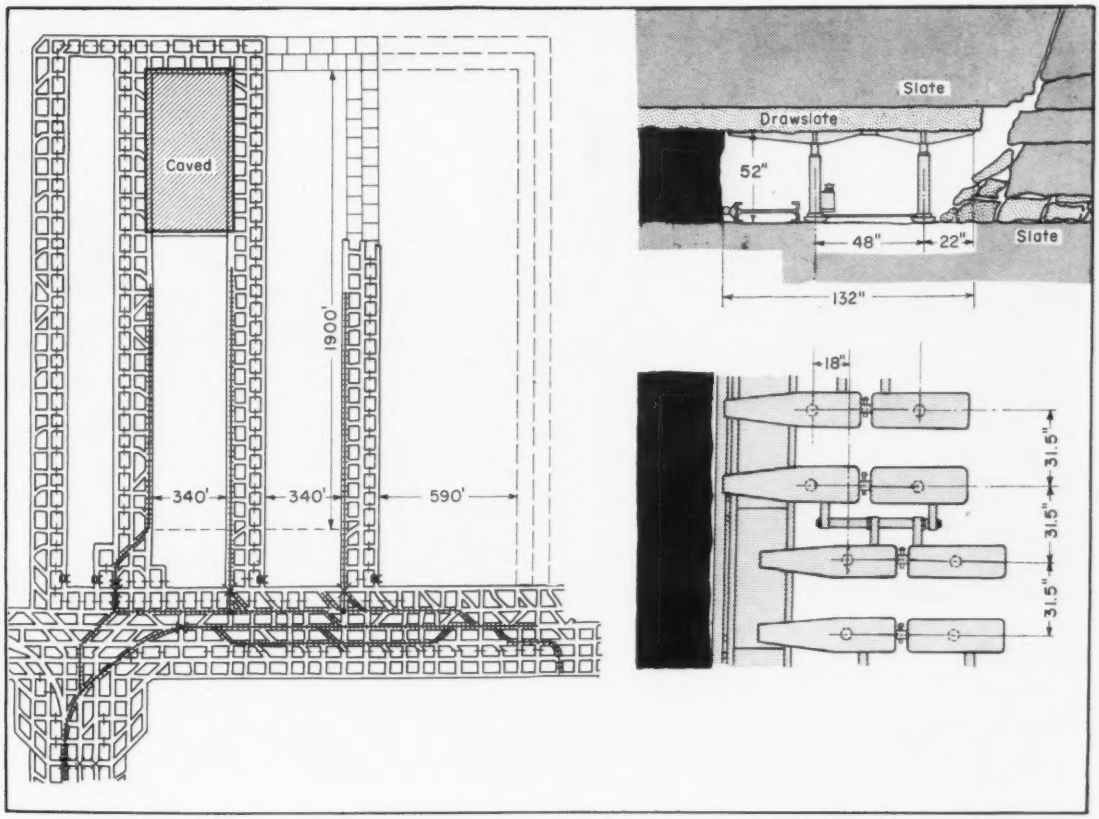
### New self-advancing hydraulic roof-supports and longwall planer team up for . . .

# Greater Efficiency, More TPM

**GOOD ROOF FALLS** break off in straight line near the hydraulic support to provide better control of roof.

MORE THAN A 50% REDUCTION in manpower, better roof control, increased production and minimum maintenance and supply costs are the major benefits resulting from the use of self-advancing hydraulic roof-support units in a new coal-planing setup at the Keystone mine of Eastern Gas & Fuel Associates, Keystone, W. Va.

The Keystone mine is located in the Pocahontas No. 3 seam which has an average height of 52 in. The seam is overlaid with about 1 ft of friable drawrock which is difficult to support in pillar operations. Approximately 25% of this drawrock is unavoidably loaded by continuous miners working in pillars. However, it is removed in main headings to gain height for better haulage and ventilation. The roof above the draw-




**MINING PLAN,** and roof-support system and planer layout (top and side view) detail the longwall mining system.

rock consists of about 150 ft of shale, sandy shale and thin sandstone beds. Above this is approximately 80 ft of massive sandstone.

The self-advancing hydraulic roof-support units and planer combination are manufactured by Westfalia Lunen, Germany, and marketed in this country by Mining Progress, Inc., Highland Mills, N. Y.

## Panel Development

The initial planer section or panel was developed with two 3-heading entries on 500-ft centers. These entries were connected at the end by bleeders to form the longwall. The longwall face was approximately 340 ft wide (solid coal) and the panel is about 1,900 ft long. Subsequent panels require only one 3-heading entry to be developed because the third heading of the leading 3-heading entry serves as the tail-driven entry for the next panel (see illustration).

The first and second panels have been mined completely. At present the planer is working the third panel which has a much longer face than the first two. This panel was developed on 750-ft centers, providing a solid face of approximately 590 ft.

Drawrock is taken in the outside headings of each panel entry. A belt conveyor is installed in the first entry of the lead heading, and track in both the tail and lead entries for transporting men and supplies.

Ventilation is provided by intake splits up both head and tail entries with the head entry carrying the main split which crosses the face. Returns are provided in both head and tail entries with bleeding from the rear.

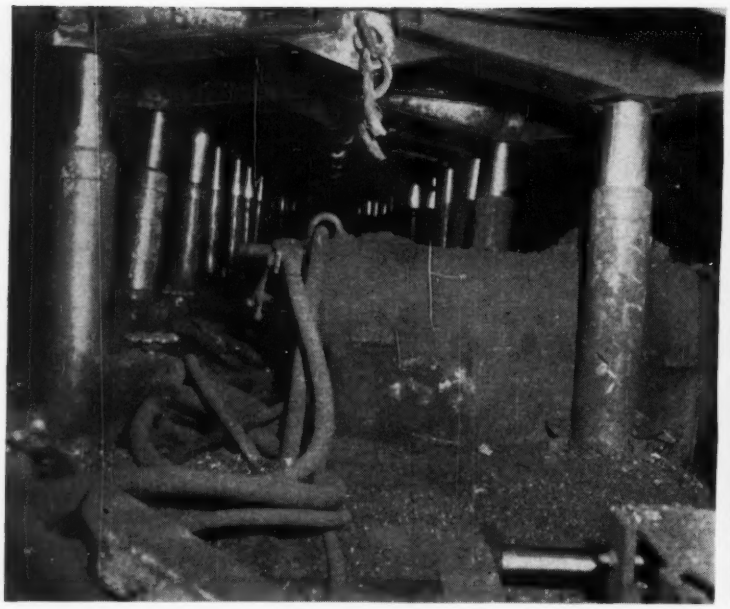
## The Roof-Support System

The width of the support area behind the planer face varies from 10 to 12 ft. Roof is supported along the entire 590-ft face, including head and tail entry, by the self-advancing units, which are located behind the planer conveyor and spaced approximately 32 in apart. These supports are equipped with steel headers approximately 14 in wide. The unsupported area between headers is about 20 in. These headers are mounted on top of the hydraulic jacks and are coupled together. The front bar extends over the chain conveyor which is a part of the face unit.

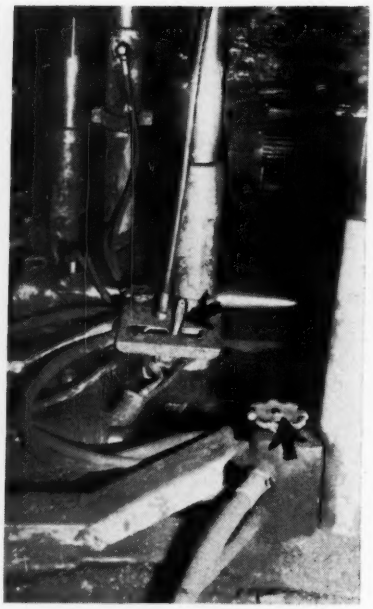
The support system for the 590-ft face requires approximately 122 sets of support units. Each set includes two parallel support frames which accommodate four hydraulic jacks (two to each frame). These frames are connected to a shifting cylinder, which has a maximum stroke of 18 in, by flat spring-steel plates.

The hydraulic jacks are designed to accept extensions to provide for variations in seam height. Westfalia Lunen supplies several jack sizes and the one used at Keystone provides for variations in seam height from approximately 35 in to 70 in.

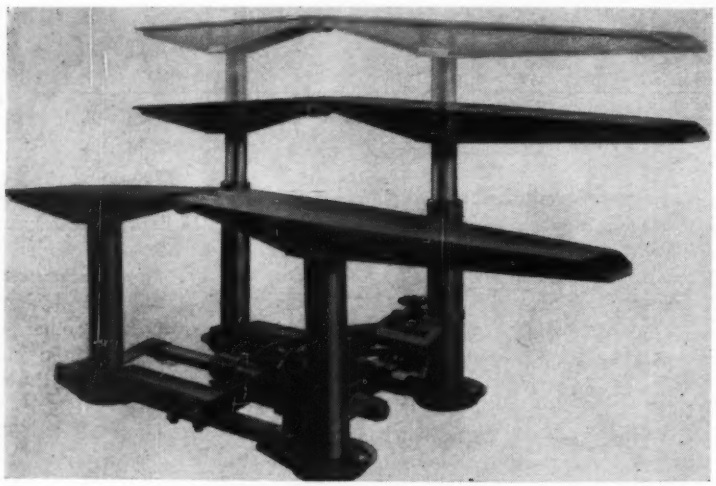
The hydraulic setting load ranges up to 30 tons with yielding loads varying from 33 tons to 44 tons.



**HYDRAULIC PUMP UNIT** is designed to serve 30 roof-support sets or 120 jacks. It is equipped with two parallel connected double-acting compressed-air driven hydraulic pumps.



**SUPPORT UNITS** are equipped with two pressure control valves and a shifting-cylinder control valve.



**ROOF-SUPPORT UNIT** illustrates how variations in seam height are obtained. The jacks are designed to accept extensions for various seam heights.

Various yielding loads can be achieved by exchanging preset pressure-relief valves in the hydraulic control assembly.

Each frame, consisting of two jacks and two headers, is controlled by a hand-operated valve mounted on the lead jack. The valve is designed to provide pressure protection to ensure that carrying capacity will be maintained if the pump fails or the hose is damaged.

The hydraulic shifting cylinder which enables each set of jacks to be moved forward is operated by a four-way valve and is capable of applying 1½ tons pressure to move the frame forward.

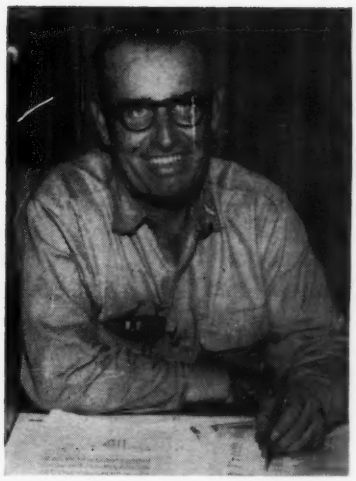
Roof beams consist of two steel headers connected with a coupling pin. Each beam rests on a ball joint on top of the jack. The leading end of the headers extend 39 in toward the face in front of the jack. These headers are capable of supporting 10-ton loads without permanent deformation.

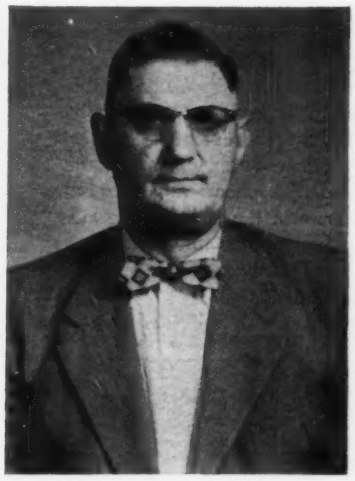
Hydraulic pump units are mounted on skids and attached to the planer conveyor. They advance with the planer and roof-support system automatically. The units are 51 in long, 16 in wide and 25 in high and have a hydraulic-oil capacity of 34 gal. They are provided with two parallel connected double-acting compressed-air driven hydraulic pumps, and associated filters, valves and gages. Pumps are designed to effectively serve 30 hydraulic roof-support units.

## Operation of the Roof-Support System

Pump operation requires approximately 60 psi of compressed air. This air is split and each split of air drives separate hydraulic pumps. One of these pumps produces low hydraulic pressure – 1,400 psi – at high volume. The other pump provides higher pressure–3,600 psi–at low volume. The latter pump has a pressure range from 1,400 to 3,600 psi and can be regulated by using air reducing valves.

The purpose of this dual-pump arrangement is to supply ample hydraulic oil to speed the setting of jacks and at the same time provide variable pressure to set the jacks against the roof at different loads.





## Eastern Gas & Fuel's Longwall Mining Team

**CLEOPHUS SHORT,** superintendent, started his career with Eastern Gas & Fuel in 1934 at Helen, W. Va., advancing to section foreman at Helen. He was transferred to the Kopperston No. 1 mine in 1940, and in that same year Mr. Short was promoted to general assistant mine foreman of No. 1 mine and in 1942 was transferred to the company's No. 2 mine in the same capacity. Within a month after his transfer he was promoted to general mine foreman and held this position for 4½ yr. In 1945, Mr. Short was appointed superintendent of the Kopperston Operation and in 1953 he was transferred to the Keystone mine serving in his present capacity.

**W. W. MABE,** resident engineer, graduated from Virginia Polytechnic Institute with a degree in mining engineering. He joined Eastern Gas & Fuel in 1941 as a rodman at the Eccles, W. Va. operation. He served with the U. S. Army for 4 yr (1941-1945) during World War II. Returning from service Mr. Mabe rejoined Eastern Gas & Fuel. In 1947 he was transferred to the Kopperston operation and served as draftsman. A year later he was promoted to resident engineer and has served in this capacity at the company's Wharton No. 1 mine, Stotesbury No. 8 and at Keystone since December, 1960. Mr. Mabe has held various engineering positions at Eccles, Keystone and Helen.

**C. O. CARMAN,** production engineer, is the fifth generation of miners. He majored in electrical engineering at Washington & Lee University and later became an instructor of mining extension classes for West Virginia University. Mr. Carman began his employment with Eastern Gas & Fuel in 1941 as general mine foreman at the Kimberly mine, Kimberly, W. Va. In 1942 he was transferred to the Carswell mine in McDowell County as assistant general foreman. Since that time he has served as ventilation foreman at the Stanaford mine, general foreman and superintendent at Stotesbury No. 8, from 1950 to 1958 and since 1958 has held the position of production engineer.

---

Hydraulic oil is pumped to the support units through hoses tested at 7,000 psi. High and low pressure hoses have an inside diameter of 13 mm (0.51 in) and 25 mm (0.98 in), respectively. Oil is filtered after it is returned to the tank. The system does not require an expensive hydraulic oil.

The two hydraulic pumps are so designed to provide a wide range of pressures for the support units. This is accomplished by the air pressure reducing valve on the high-pressure pump mentioned previously. Minor adjustment of this valve can vary the setting load for jacks from 12 to 30 tons. The pressure setting on the shifting cylinders can be varied from 1.5 tons to 3.6 tons. For example, if a roof fall fouled one of the jacks and the normal pressure of 1.5 tons was unable to release it, the pressure could quickly be increased to 3.6 tons to provide the necessary force to pull it out. The performance of the pump units can be changed by varying the air pressure in the supply lines which in turn drive the hydraulic pumps.

A total of 122 sets of hydraulic self-advancing units or 488 hydraulic jacks and as many steel headers are used to support an area 10 to 12 ft wide for the full length of the face. Only four men are needed to keep the jacks advanced. Each man is responsible for handling approximately 30 sets. In addition, he is responsible for cleaning up fine coal left by the planer, advancing air-operated cylinders which keep the conveyor forced against the face, and for inspection of his particular section for abnormal conditions of roof, face and equipment. The steps involved in advancing a support unit, i.e., releasing, advancing and resetting, take approximately 10 sec. The procedure for advancing the supports is to release one frame (two hydraulic jacks) by opening the pressure control valve located at the base of the front jack. Each frame is equipped with a pressure control valve. As soon as the steel headers which are mounted on top of the jack are free of the roof, the shifting-cylinder control valve advances the frame to the desired position. This control valve is located at the base of the left frame, and controls the movement of both frames independently. The pressure control valve is then closed to provide the necessary pressure to set the jacks and headers against the roof. When this frame is set the jacks on the other frame are released, advanced

and reset. Only one frame is advanced at a time.

The load at which the jacks are set against the roof is governed by the air pressure supplied to the pump unit. This pressure is usually controlled by the operator.

Pumps do not run when the section is idle. A check valve retains the pressure in the jacks. There has not been any appreciable subsidence due to leaky valves on the support units.

The control valves located on the frames are set to yield at 33 tons, at present. Incidentally, the weight-carrying capacity of the 122 sets of supports (488 hydraulic jacks) is such that it would support a coal train over 1¼ mi long.

The success of the planer depends on a proper roof-support system. A fair estimate of the normal, or average mining conditions on the long face usually does not appear until a distance equal to the face length is mined. The first section or panel mined at Eastern Gas & Fuel did not provide average conditions since it was located in virgin territory, at Keystone Mine. However, by the time two or more sections were mined sufficient experience was gained in the longwall system to determine what to expect as to average conditions. The average begins to appear as the mined out area increases.

Roof falls follow the advancing roof supports very closely as a general rule. The immediate roof, consisting of the 1 ft of drawrock previously mentioned, is the first to fall. The 160-ft band of shales, sandy shales and thin sandstone beds experiences considerable movement. The 80-ft band of sandstone is not expected to do much moving, other than bending, until several panels have been removed.

As more panels are mined future faces are expected to have better conditions. And as the unsupported area increases, pressure from the 80-ft band of sandstone is expected to react favorably on the coal seam to further improve mining conditions.

**Manpower Requirements** — The number of men required to effectively man the 590-ft face is 10, including:

Operator and helper (head end).
Operator (tail end).
Four hydraulic jack setters.
Boom operator.
Mechanic.
Foreman.

**Maintenance** — Maintenance of the hydraulic support units and pumps has been good. Hydraulic hose failure due to pressure is unheard of; failure of hydraulic jacks due to excessive roof pressure is still in the unrecorded category; steel headers have withstood excessive bending; and hydraulic pump failures have been limited to minor repairs.

Maintenance troubleshooting has been limited to replacing damaged hose, "O" rings on hydraulic pistons, and springs in hydraulic pumps and control valves.

The top and especially the 1 ft of drawrock, according to company officials, was never supported as well in the Keystone mine as with the hydraulic supports. It seems that full automation of the longwall face could become a possibility in the near future.

# Bethlehem Forged-Steel Mine Car Wheels . . . you can depend on them all the way

Bethlehem Mine Car Wheels are made of a special grade of open-hearth steel. The forging process removes the objectionable properties of the cast-ingot structure, and gives the wheels great strength, toughness, and resilience for long, trouble-free life.

We can furnish wheels in 12-in., 14-in., 16-in., and 18-in. diameters. They are tried and proved; you can depend on them all the way.

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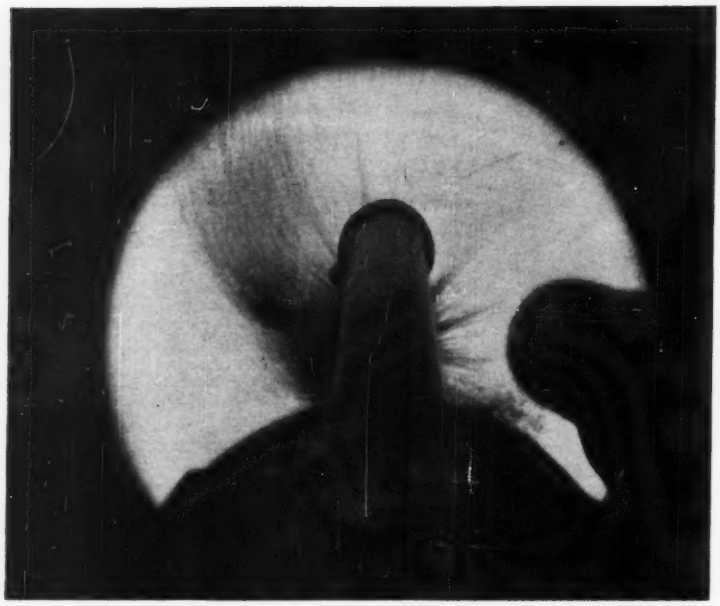
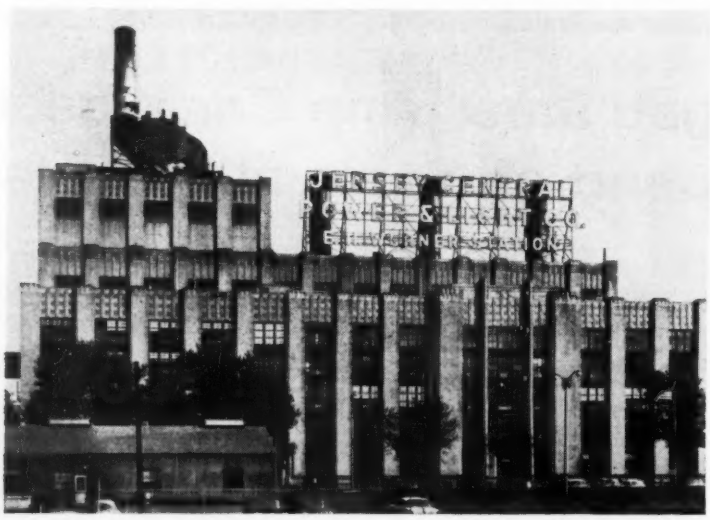


**THIS IS COAL SLURRY,** containing 70% coal and 30% water, being introduced into the ignition zone of a cyclone furnace in on-line operation of a power plant at South Amboy, N. J. This may be the giant step leading to the construction of a coal pipeline to the East Coast from northern West Virginia and western Pennsylvania.

# Direct Firing Of Coal Slurry

Extensive test run at New Jersey power plant demonstrates feasibility of burning coal-pipeline product directly. Cyclone furnaces in regular service are fed with coal slurry at 70-30 solids-to-water ratio.



**THE STACK AT THE LEFT** in this view of the E. H. Werner Station discharges the products of combustion resulting from direct firing of coal slurry.

CALL IT a breakthrough, a milestone or whatever, the recent commercial-scale test on burning coal slurry at the Werner plant of Jersey Central Power & Light Co., South Amboy, N. J., is big news for coal. Two cyclone furnaces at the Werner plant burned nothing but pipeline slurry for a period of several weeks in late October and early November. There is some reduction in burning efficiency, as expected, but this is more than compensated by the overall economy that direct firing of slurry can provide.

## The objectives

One of the principal incentives in the test program was the desire for lower costs in transporting coal from the mines to East Coast power plants. The ultimate objective is a pipeline from the coal fields in northern West Virginia and western Pennsylvania to the New York-Philadelphia areas. In addition to lower transportation costs, direct firing of slurry eliminates much expensive coal-handling equipment. In a plant designed for the use of slurry, there would be no need for railroad sidings, barges, docks, coal towers, pulverizers, conveyors and the like.

The successful demonstration at the Werner plant is the culmination of joint research among Consolidation Coal Co., Babcock & Wilcox

Co., Texas Eastern Transmission Corp. and Jersey Central Power & Light Co. The slurry burned at South Amboy actually passed through Consol's 108-mi pipeline from Cadiz, Ohio, to Cleveland. It was carried by barge from Lake Erie to Newark, N. J., via inland canals and the Hudson River, and stored in tanks at Pitt-Consol Chemical Corp. The slurry was transported in barges to the power plant and pumped into a 1,000,000-gal storage tank. It was pumped, as received, from the storage tank to a surge tank, thence directly to the burner nozzles in the cyclone furnaces.

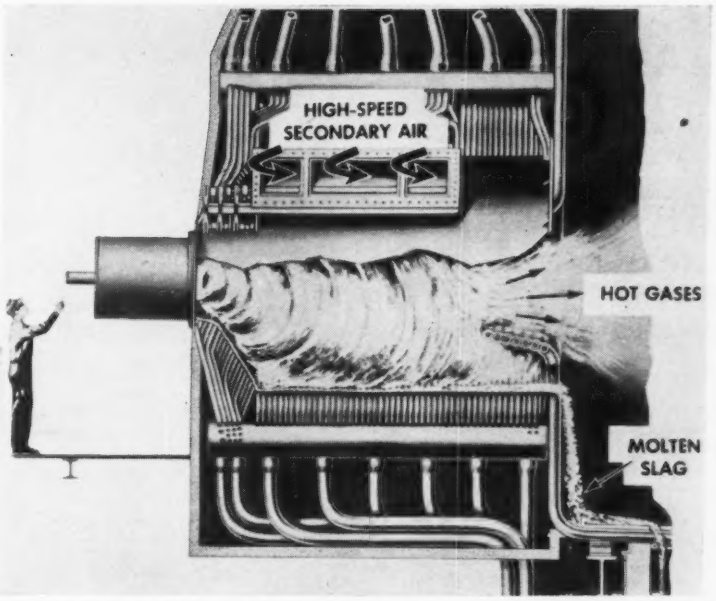
The coal consumed in the test amounted to 10,000 tons of minus 8-mesh, prepared at Georgetown preparation plant of the Hanna Coal Co., a division of Consol. It was pumped through the pipeline to Cleveland at a concentration of 60% solids, by weight. Storage in Cleveland permitted decantation of some of the water, resulting in a slurry containing approximately 70% solids.

There has been no difficulty in maintaining the suspension since the slurry handles and stores much like oil. If settling is evident during a long period of storage, an air lance may be employed to reconstitute the mixture.

## The cyclone furnace

The Babcock & Wilcox cyclone furnace firing coal slurry is the ultimate in simplicity and economy. It requires a minimum investment in equipment and a minimum of labor. The dry coal handling equipment which is eliminated in the slurry-firing method represents from 5 to 7% of total investment, saving about $3,500,000 in a typical 500,000-Kw station.

As explained by Neil W. Eft, research engineer, Babcock & Wilcox, the slurry with no auxiliary fuel is introduced at low pressure (35 psi) into the front of the cyclone furnace through a simple pipe and spray nozzle. The fuel is distributed in the furnace in a hollow conical spray. Hot primary air at 700F is introduced tangentially behind and around the coal nozzle. Spinning around the coal nozzle, the primary air vaporizes the water from the finer coal particles and accelerates them into a tangential path. Ignition of the finer particles takes place almost instantaneously.




**CYCLONE FURNACE** is the ultimate in simplicity and economy. Slurry which requires minimum handling is pumped directly into input line at left. Hot gases leaving the cyclone enter the boiler unit to generate steam.

Hot secondary air, five times the volume of the primary air, and spinning around the cyclone in the same direction, is introduced immediately after the ignition zone. Centrifugal force throws the coal particles to the outer wall of the furnace. Temperature in the furnace is 3,000 F —hot enough to liquefy the ash which then flows down the furnace walls into a slag pit. Studies show that an entering particle of coal is dried, burned and slagged in 1/100 sec. Water in the slurry goes up the stack as vapor. There is less vapor than in a gas-fired boiler.

Although ignition of the coal-water mixture is more difficult and the maximum temperature reached is lower than with dry coal, these natural differences due to the character of the fuel are not overly detrimental to the combustion process. The B&W cyclone furnace is the only type of equipment available today to burn coal slurry directly.

Many generating stations are equipped with pulverized coal-fired boilers which cannot use coal slurry directly. Coal suitable for these stations should contain less than 20% moisture. This means that about 60% of the water in coal slurry must be removed before the coal can be pulverized and burned.

At the Alliance (Ohio) research center of B&W a cooperative program between Consol and B&W has already shown that the excess moisture in coal slurry can be removed in either a disc filter or a solid-bowl centrifuge. The reduction in moisture content not only increased the efficiency of the steam boiler but also permits the coal to be conveyed and pulverized using the equipment currently available in many plants. The removal of this water does require additional capital investment.

However, an entire existing plant can easily convert to this new fuel and take advantage of the reduction in transportation costs. The effect of this on the nation's electric utility industry is of far-reaching economic significance.

## Pipeline to the East

"Texas Eastern now considers its primary objective to be the pipeline transportation of energy in whatever form it is needed," declares T. W. Thagard, vice president, Texas Eastern Transmission Corp., in explain, ing that his company's interest in this project was stimulated by the fact that its operations had already been diversified to include handling

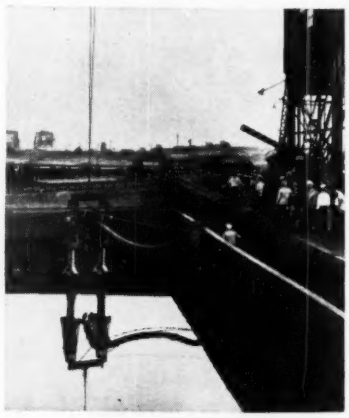
**SOURCE OF THE NEW FUEL** is the Georgetown preparation plant of Hanna Coal Co., near St. Clairsville, Ohio. Slurry for South Amboy test actually passed through Hanna's 108-mi pipeline to Cleveland.

energy in forms other than natural gas.

Two of the basic requirements for economic pipeline transportation are large reserves at the supply end and large volume requirements at the market end. Virtually unlimited coal reserves exist in many parts of the country, and certainly the electric generating stations have large volume requirements, not only today but expanding constantly with the increasing use of electricity. With these two essentials already in existence there is every reason to expect growth in coal pipelining.

Pipeline transportation provides unrivaled reliability. Furthermore, transportation rates on the movement of tonnages between points by all methods tend to become more stable with increased competition. In the event of a national energency, a high-capacity eastern coal-pipeline system already in operation would be of tremendous value to the security of the nation.

In pointing to the successful operation of the Cadiz-to-Cleveland pipeline, which to date has transported more than 5 million tons, Eric H. Reichl, director of research and development, Consolidation Coal Co., says continuing research has resulted in the ability to increase the percentage of solids in coal-pipeline streams from the original 50-50 to the present 60-40. Other advances in the art have been made that stabilize the slurry so that it handles much like fuel oil in conventional tankage and tank cars.



**DESTINATION** is the Werner plant to which the slurry was transshipped by barge. Pumps are lowered into barge to transfer slurry to 1,000,000-gal oil storage tank for subsequent direct firing.

Joseph Pursglove Jr., president, Pitt-Consol Chemical Co., foresees a pipeline to the East possibly as large as 30 in in diameter.

With regard to the actual demonstration at the Werner plant, John E. Logan, vice president — operations, Jersey Central Power & Light, points out that in burning slurry the company expects to encounter some reduction in boiler efficiency, but that overall financial benefits can be realized from its use.

In making the plant available, Mr. Logan said, JCP&L acted in the interest of the entire utility industry. Electric companies the country over followed the test with great interest.


## At Inspiration Consolidated Copper Co.:

# No replacements in thirteen years with Anaconda SH-D shovel cable

**ALL THE SH-D SHOVEL CABLE** ever installed at Inspiration Copper is still in service, including the original order supplied in 1948—a total of over 12,000 feet of SH-D cable without a single "retirement." You can't get replacement costs any lower than that.

Unlike many "shovel cables" that are just ordinary portable power cables hooked up to a shovel, Anaconda SH-D Shovel Cable is specifically designed and built for one particular job. For example:

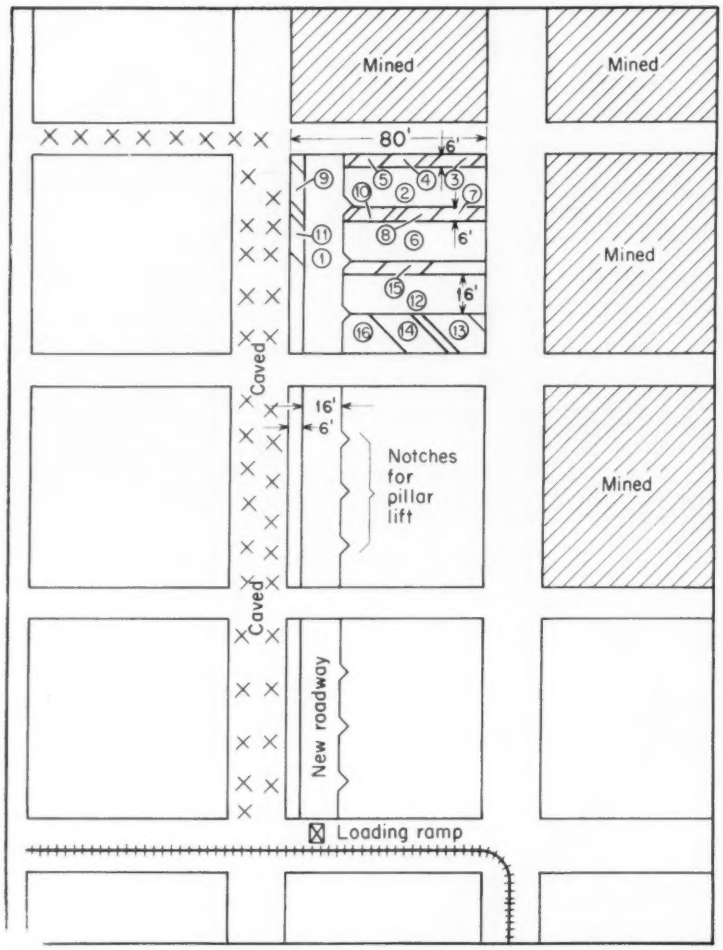
- The neoprene jacket on SH-D cable is specially compounded in a unique Anaconda process that imparts extra crush resistance, exceptional toughness and abrasion resistance. This same neoprene jacketing material has earned a fine reputation on shuttle-car cable, too.
- SH-D shovel cable is insulated with Anaconda Butyl. Nothing can beat AB Butyl for withstanding ozone, heat and moisture.
- SH-D has Anaconda's specially designed grounding conductors which minimize breaks due to kinks and runovers.

Every design and component of SH-D shovel cable has years of outstanding on-the-job service to back it up. For more information about Anaconda SH-D Shovel Cable, contact Anaconda Wire and Cable Company, 25 Broadway, New York 4, New York, Department EFL-1-CA.

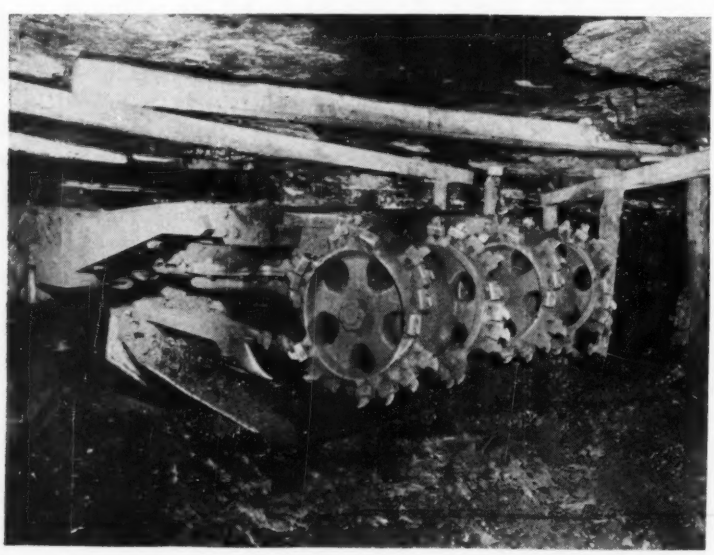
61298

ASK THE MAN FROM
**ANACONDA®**
FOR SH-D NEOPRENE-JACKETED SHOVEL CABLE

# Conversion to Continuous System




**PILLARING PLAN** frequently calls for cutting a new roadway through pillars. Notches for pillar lifts are cut as miner drives new roadway.



**EFFICIENCY BOOSTER** at Lynn Fuel, continuous miner increases section output 250%. Unit cuts out only the clean portion of the seam, enables the company to load quality product without washing plant.

PRODUCTION UP 250% and manpower needs down 53% is the record at Lynn Fuel Co., Morgantown, W. Va., since switching to continuous mining.

Working under less than favorable conditions, a seven-man crew employs a Lee-Norse CM 38 continuous miner to produce an average of 375 tons per shift. This average includes nonproductive time spent cleaning up rock falls and timbering old entries before attacking a new pillar. The best production shift to date was 600 tons, or 85.7 tons per man.

Lynn Fuel produces from the Pittsburgh seam, which has an average mineable thickness of 6 ft and is free of clay veins and sulphur balls. The immediate roof is friable and includes 3 to 8 in of bone, 3 to 36 in of coal and bone, and 2 to 8 ft of soft slate. Overlying this material is hard sandstone, which forms the main roof.

Lynn Fuel began mining at its present location after taking over the old Davidson-Connellsville Coal & Coke Co. property in January, 1960. Employing one track and one off-track conventional unit in their initial mining, the present operators have been recovering pillars since that time. Production has been exclusively by continuous methods since July, 1960.

Since the mine had been developed over 10 yr ago and considerable rock had fallen in the headings, the section crews spent considerable time cleaning up roadways when using conventional equipment. Furthermore, extra men were needed to help with this work. Maintaining the necessary number of working places required with a conventional setup proved an expensive and difficult task. As a result, management considered changing mining methods a few months after acquiring the property.

To consolidate mining in one

# Ups Section Output 2½ Times

place and eliminate much of the extra cleanup work, as well as simplify roof-control problems, the company turned to continuous mining. By April 1, 1960, 3 mo after starting operations, management had revamped mining plans and had ordered a Lee-Norse 38 continuous miner. Arriving during the miners' vacation, in July, 1960, this unit was taken underground and was ready to produce by the time the men returned to work.

Within a week after going into service, the continuous miner was turning out good tonnage. Officials report that in this short time they were convinced that the investment would pay off in increased production and better roof control.

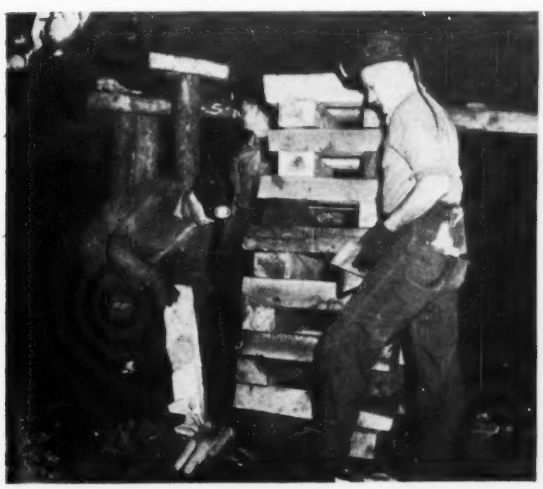
**SHUTTLE CARS** receive coal directly from continuous miner, carry it to loading ramp and discharge directly into steel mine cars.

## Mining the Coal

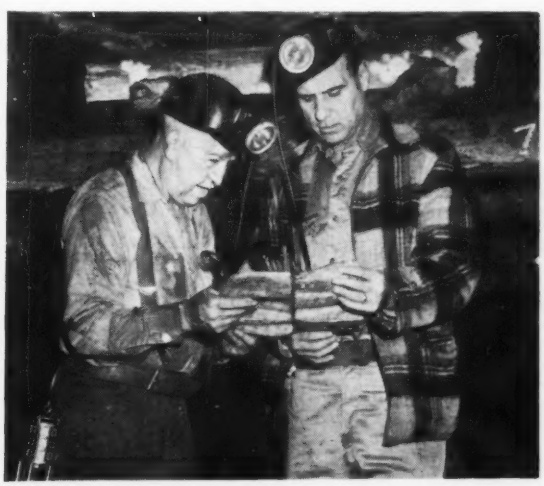
The continuous miner produces coal on two shifts. On the day shift, the crew includes a miner operator, two shuttle-car drivers, one timberman, one mechanic, one motorman and one foreman—a total of seven. The second-shift crew is identical, except that no mechanic is assigned to the section.

Aside from boosting productivity to a high level, continuous mining has yielded a number of other benefits. For instance, the unit has proven to be efficient in clean up work in crossing old workings. Mine management points out that the continuous miner picks up an average of five to eight shuttle car loads of rock in crossing a heading. In some instances it loads as many as 13 cars of rock. The unit handles this assignment easier and faster than conventional equipment.

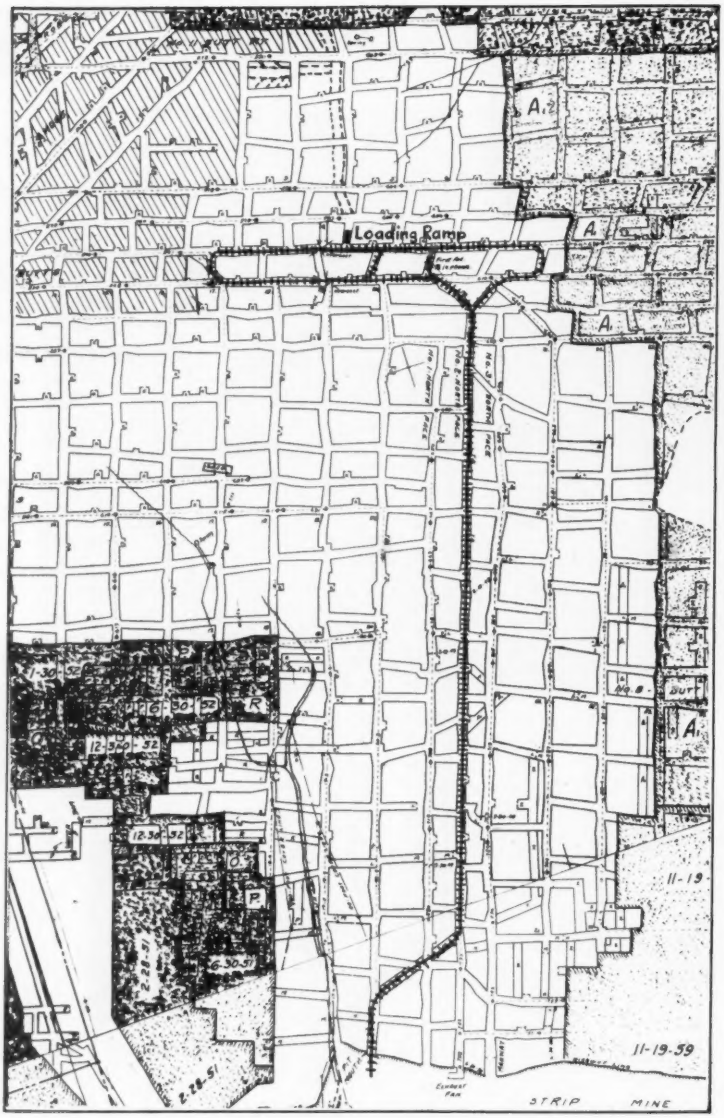
Since falls fill most of the old headings, the company employs a highly flexible mining plan that requires a minimum of rock loading. This plan normally includes establishing a new loading point three blocks outby the fall line at previously extracted pillars. The continuous miner then drives a new haulway through three pillars, handling rock only when crossing headings and leaving a 6-ft protective wing parallel to the old heading.



**CRIBS** provide additional roof support at intersections or roadways which will be used for considerable length of time.



**PLANNING** operations are H. A. Riley (left), mine foreman, and Matthew Tait, vice president.




**CONCENTRATED MINING** enables continuous miner to remove one block in two shifts. Roof control is simplified and recovery is increased. Loop track facilitates car handling and prevents delays at the loading ramp.

As the miner drives the new haulway it cuts notches into the pillar where lifts will be started on retreat. This procedure enables the miner's cutting head not only to get the lift started in the desired location but also to produce at full capacity when starting the lift. Details of this system are shown in an accompanying sketch.

In driving through a pillar, the miner advances 8 to 10 ft, making an opening 8 ft wide. It then drops back and widens the opening to 16 ft and advances 20 ft. Mining then alternates from side to side.

Because of the friable nature of the immediate roof, bolting cannot be employed. As a result, wood crossbars are set on 4-ft centers as soon as the miner has advanced a 16-ft opening 20 ft. Straight posts are set as needed to provide additional support. In wide areas and where roadways will be maintained for considerable time, face crews build cribs of 5x7x30-in timber. These supports are not recovered. Most of the pillars measure about 80x80 ft and under average conditions a pillar is removed in two shifts.

**TOP EXECUTIVES** at Lynn Fuel are William Tait (left), president, and Matthew Tait, vice president.

## How Lynn Fuel's Coal Analyzes

| | |
|---|---|
| Moisture | 2.87% |
| Volatile matter | 35.15% |
| Fixed carbon | 53.77% |
| Ash | 8.20% |
| Sulphur | 2.75% |
| Btu | 13,677 |
| AST | 2,200 F |

## Transportation

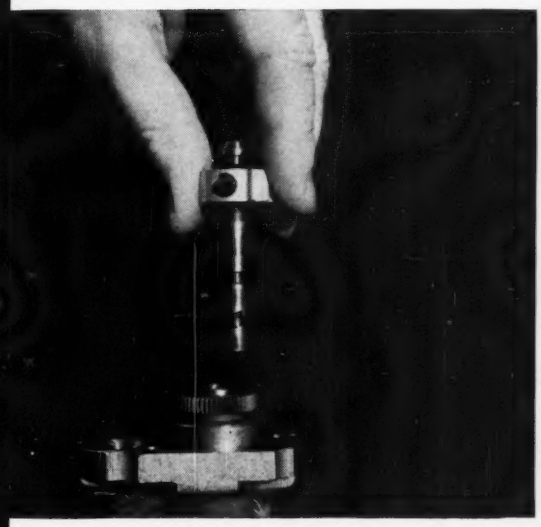
Two Joy 5 SC shuttle cars alternately receive coal directly from the continuous miner and transport it to the loading ramp. The miner loads a 5-ton shuttle car in 1 to 1½ min.

At the ramp, shuttle cars discharge directly into 5-ton steel mine cars whose capacity matches that of the shuttle cars. Mine cars, traveling on a track loop, are moved by the loading point by a 6-ton General Electric locomotive. Lynn Fuel relies on a mine locomotive to handle the cars because the original mine layout does not lend itself readily to systematic planning of loading points.

A second 6-ton General Electric locomotive pulls 15-car trips from the loading loop to an outside dump. There the coal falls into a hopper and feeds onto a conveyor leading to a steel storage bin. A fleet of trucks then transports the coal 1 mi overland to a tipple overlooking the Cheat River.

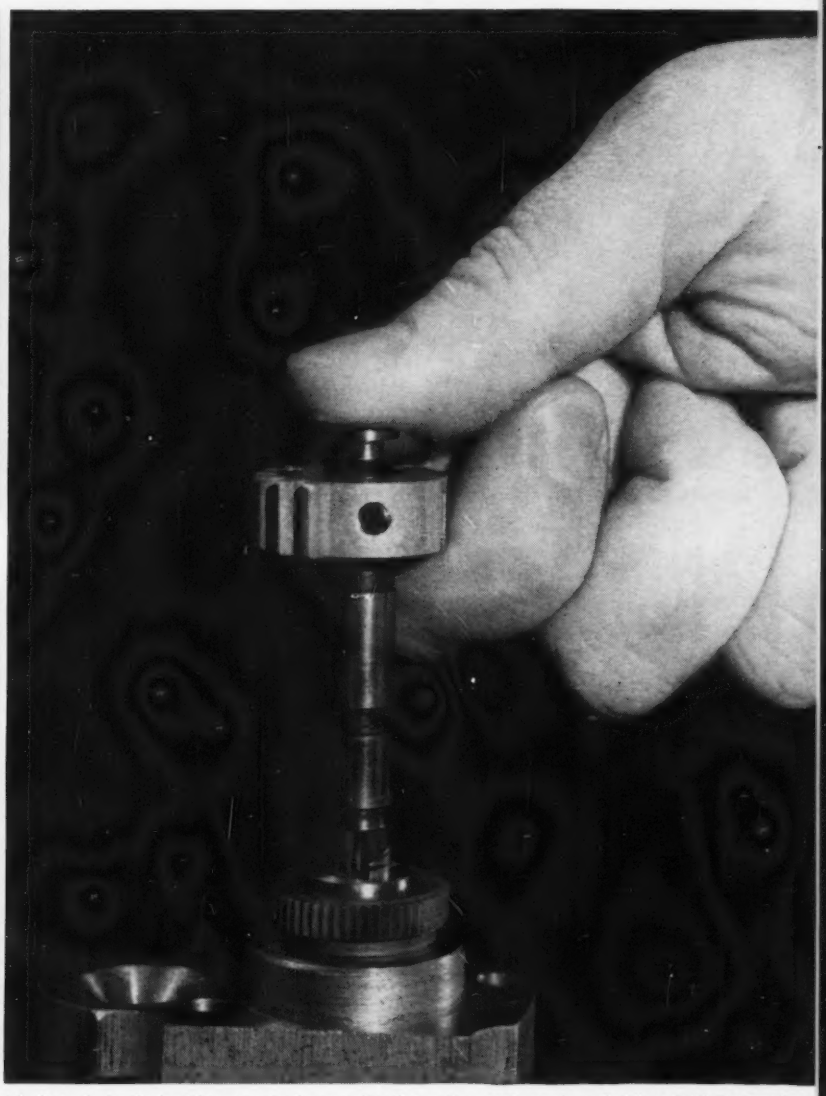
At the tipple, coal is hand-picked and crushed to 1½x0 before feeding

# It takes 125 millionths of an inch and just 60 seconds to measure Caterpillar engine quality



1. Remove the plunger from the fuel injection pump of a Cat Engine.

2. Hold the plunger in your hand for 60 seconds.



3. In that minute, the heat from your hand causes the plunger to expand enough so that it can't fit the barrel.

## This shows the close tolerance and refinement built into Caterpillar Engines

Certainly, we could design a fuel system to less exacting tolerances. It would probably operate satisfactorily . . . for a while. But it would need periodic maintenance, overhaul and adjustment.

Caterpillar engineers feel that an engine owner should be free from constant tinkering and adjustment. He should also be assured that the system will deliver the quantity of fuel needed by the engine from cycle to cycle and from cylinder to cylinder.

That's why the Caterpillar designed and manufactured fuel system is held to such close tolerances. "Shade tree mechanics" won't find any field adjustments to make and it will operate practically trouble and maintenance free for the life of the engine provided clean fuel, free from contaminants, is always used.

Quality like this, throughout the engine, is available when you specify Caterpillar. It will be worth your time to investigate the new Caterpillar line of high-output diesel and natural gas engines that give you more horsepower per pound per dollar.

**Industrial Engines**—Diesels to 950 HP . . . natural gas to 720 HP . . . all-new 1960 and 1961 designs . . . attractively priced.

**Truck Engines**—220 HP 1673 Diesel Truck Engine . . . tinker-free fuel system . . . idles without fouling . . . burns non-premium low-cost fuels.

**Electric Sets**—New statically regulated, statically excited generators . . . simple to install . . . simple to maintain . . . models from 30 to 600 KW.

CATERPILLAR



Engine Division, Caterpillar Tractor Co., Peoria, Ill., U.S.A.

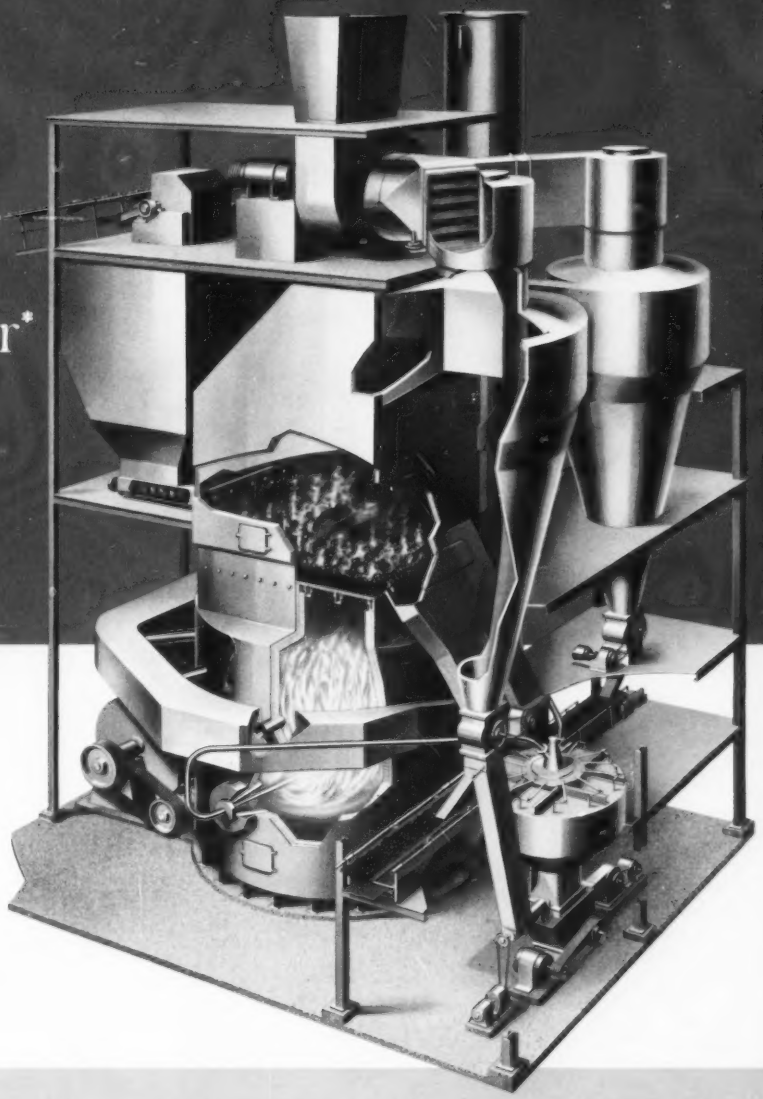
to an aerial tram spanning the river. On the opposite side of the river the tram discharges coal into a storage bin for delivery to railroad cars on a sidetrack of the B&O R.R. A company-owned shifter engine handles the railroad cars on the sidetrack. Coal moves by rail to utility customers.

Management notes that switching to continuous mining has enabled the company to market a product with a consistently lower ash. Today, ash content of the 1½x0 averages 8.2% and in a number of shipments has been as low as 6.4% and 8.0%. This quality of coal is now available because the continuous miner removes only the clean portion of the seam, and the bone and roof coal are not disturbed. Hence these roof impurities can be held with crossbars.

Since the coal is not washed, the company reports that the customers not only receive a uniform quality product but also are not troubled with frozen coal in winter. The company benefits by being able to market a quality product without the expense of building and operating a washing and drying plant.

# NEW—

## McNally Flowdryer* ...an improved fluid-type fine coal dryer



- BLOWER HP REDUCED 50%
- LESS PICKUP OF FINES
- GRATE OPENING ADJUSTABLE BY SECTIONS
- AUTOMATIC CONTROL OF FUEL FIRING AND TEMPERING

Here is a fine coal dryer—the result of over 20 years of experience in the field—which incorporates the best features of all McNally Pittsburg designed dryers.

The McNally Flowdryer is designed in various sizes to handle an output of from 25 to 500 tph of coal, or from 3 to 36 tph of evaporation per single unit. It will handle a size range varying from 1-1¼ x 0 to 10 mesh x 0, depending upon the material to be dried.

Two fans—a suction fan over the grate and a tempering air fan under the grate—provide a high evaporating capacity with very low motor horsepower. In addition, the pressures are neutralized in the coal bed so that there is a minimum pickup of fine coal.

*Patent Pending.

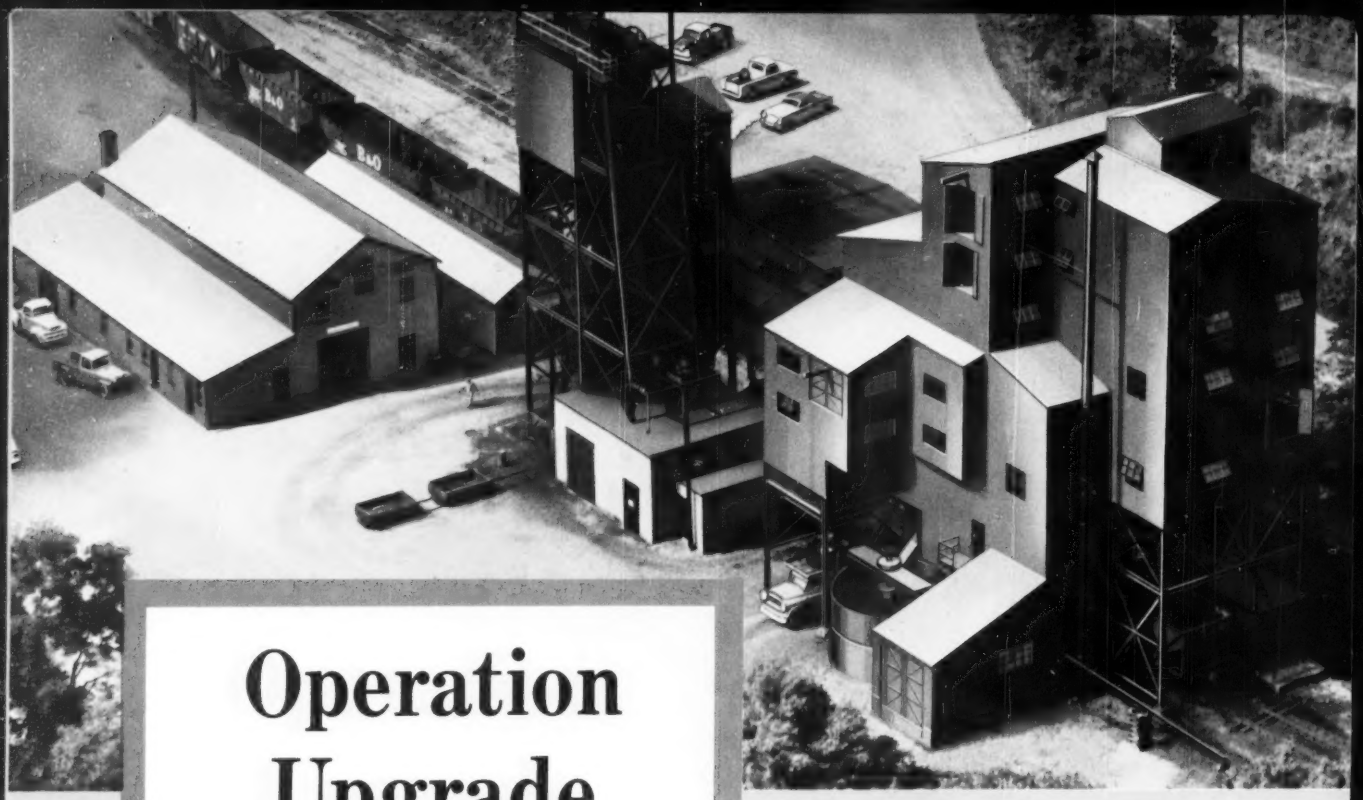
One of the outstanding features of the McNally Flowdryer is the adjustable grate. The upper plate is sectionalized, and screw adjustments make it possible to vary the openings at each section of the grate independently. This permits maximum drying efficiency and eliminates fuel waste.

The pulverized fuel firing system and the tempering air are automatically controlled to maintain a constant temperature below the coal bed and to deliver the exact volume of drying gases needed. Automatic controls are also provided for the exhaust system. WRITE FOR NEW CATALOG describing the improved McNally Flowdryer. McNally Pittsburg Manufacturing Corporation, Pittsburg, Kansas.

*ASK THE MEN WHO KNOW COAL FROM THE GROUND UP*

**McNALLY PITTSBURG**

MANUFACTURERS OF EQUIPMENT TO MAKE COAL A BETTER FUEL



# Operation Upgrade

at Century #101 Mine, Century, West Virginia

## *Bethlehem Adds McNally Lo-Flo Dense Media Vessel for Low Gravity R.O.M. Coal*

To satisfy a growing demand for metallurgical coal, Bethlehem investigated all possibilities of improving their low gravity run-of-mine coal. The problem was more efficient cleaning. Their solution was the addition to existing facilities of a McNally Lo-Flo Dense Media Vessel with automatic density regulation.

In operation, the new McNally system is effectively integrated with existing facilities. From the delivery of 135 tph of the screened raw coal, to the final handling of the flotation cleaned effluents of the polisher and centrifuge, Bethlehem's Century #101 Mine offers a fine example of the value of consulting with McNally Pittsburg.

The "Man from McNally" offers you an outstanding engineering background, plus the "know-how" that makes possible the advanced design in McNally Pittsburg plants all over the world.

Fill out the coupon for complete details on McNally Pittsburg Coal Preparation Equipment.

## *MAIL THIS COUPON*

McNally Pittsburg Mfg. Corp., Pittsburg, Kansas

Gentlemen:

Please send me information about the following equipment:

- ☐ Complete Coal Preparation Plants
- ☐ Automatic Sampling
- ☐ Coal Cleaning
- ☐ Crushers and Breakers
- ☐ McNally Flowdryer
- ☐ Coal Preparation Manual
- ☐ Conveyors
- ☐ Thermal Dryers
- ☐ Centrifugal Dryers

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**McNALLY PITTSBURG**

MANUFACTURERS OF EQUIPMENT TO MAKE COAL A BETTER FUEL

McNally Pittsburg Manufacturing Corporation
Manufacturing Plants: Pittsburg, Kansas · Wellston, Ohio
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Printed in U.S.A.

COAL AGE Operating Guide

# Fine-Coal Treatment and Water Handling

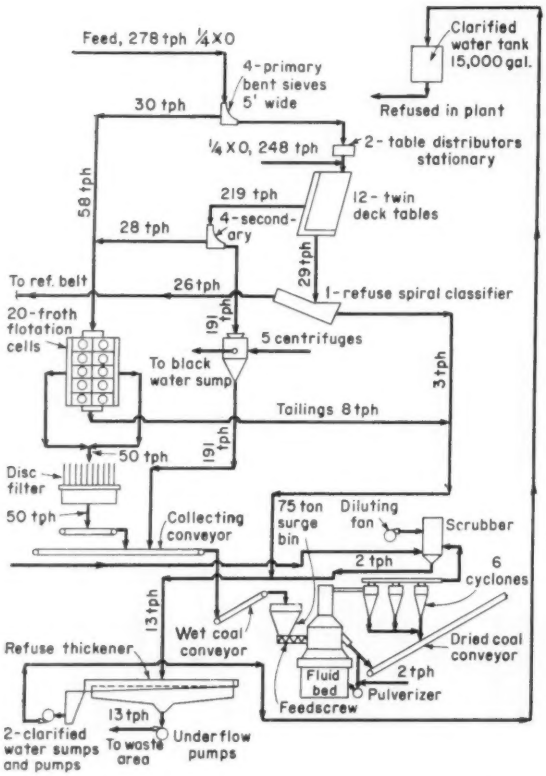
**Cleaning Methods**

**Dewatering**

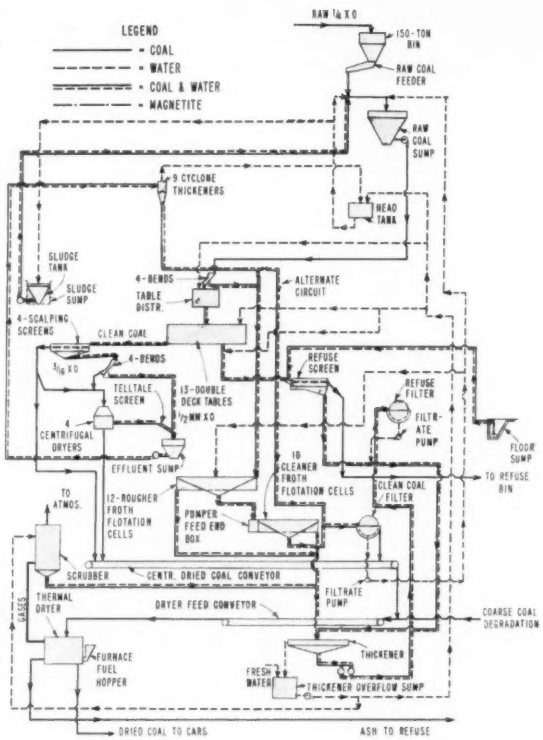
**Drying**

**Desliming**

**Water Clarification**




**FINE-COAL FLOW** features two-stage desliming with bent sieves to provide feed to flotation and table units. Centrifuges, filter and fluid-bed thermal unit with scrubber, remove water from clean product.




**TWO-STAGE FLOTATION** recovers ultra fines in wet table plant operating with closed circuit. Bent sieves deslime raw and clean coal. Cyclones thicken ½mmx0 for delivery to flotation cells.

# Fine-Coal Treatment And Water Handling

Fine-coal preparation and water handling pose some of the greatest challenges facing management today. This Operating Guide summarizes up-to-date information on methods and equipment employed for these jobs.

GREATLY accelerated changes in coal markets, demands for a more uniform product and the producer's drive for increased recovery are rapidly changing the coal preparation picture. Furthermore, there has been considerable legislation aimed at eliminating stream pollution. These new laws have forced many companies to add equipment for treating waste. And fine-coal cleaning as well as water clarification systems now are the rule rather than the exception, and cleaning of the ultra fines is growing rapidly.

Today the utility and steel markets rank as the two most important coal markets, accounting for more than 250,000,000 tons annually. These two markets will not only consume greater tonnages as our economy expands but also will take a larger percentage of coal's total output.

Unlike the major coal consumers of the past, these two industries do not demand a coarse product. As a result, fines which were considered a nuisance or little more than waste about 20 yr ago are now marketable. But coal buyers are demanding more and more that the quality of the fine coal be as good as that of the coarse coal.

Furthermore, the advent of continuous mining and the practice of full-seam mining have placed greater demands on cleaning facilities. These two developments have also contributed to the accelerated growth of fine coal cleaning.

Fine coal preparation poses some of the greatest challenges facing coal operators today, both from the viewpoint of plant operation and capital expenditures. Management faces the problem not only of choosing the proper combination from a wide assortment of preparation equipment but also the problem of justifying the cost of installing and operating these facilities.

## Wet Tables

Wet tables have been cleaning coal for more than 40 yr and are handling a major portion of the fine coal today. The main design features of a wet table are its differential motion and the riffled deck with water flowing across it. The differential motion provides a sideways conveying action along the tilted deck and the water imparts a downward motion on the sloped surface. Double-deck tables have been widely accepted and provide twice the capacity while occupying only as much floor space as a single-deck unit.

Wet tables give excellent cleaning results when they are operated correctly. When they are called on to handle a difficult washing job it is especially important to maintain the correct operating conditions.

Preparation for good table operation begins with providing a solid foundation for anchoring the table to the plant. Excess vibration can lead to loss of washing efficiency.

Successful table operation also depends to a large extent on providing a uniform feed of coal and water. For example, if the rate of coal feed increases appreciably beyond that for which the table is set, some refuse will join the clean coal and thus raise the ash content. Conversely, if the rate of feed decreases without changes in the table settings, coal probably will discharge over the refuse end.

Not only is it important to provide a uniform feed of coal and water but also to distribute them properly to the table. Proper distribution demands that the volume of solids discharged along the side of the table decrease gradually from the head-motion end to the refuse end.

To provide a uniform coal feed to tables, most modern plants rely on mechanical feeders or distributors. Not only should the volume of coal flowing to the tables be controlled but also the quality and physical characteristics. Improperly designed storage bins can cause changes in the size consist or distribution.

Excess moisture in the raw coal also can cause variations in the size distribution of the feed when dry screening is employed. Much of the fine coal clings to the large sizes and joins the coarse coal stream. Some companies eliminate this problem by wet screening the raw coal.

Just as important as uniform coal flow is a steady flow of water to the tables. Water should be available under constant pressure and it should be clean. Dirty water can interfere with flow through pipes or valves, and accumulations of dirt can block valves completely.

## Jig Washing

Jigging is one of the oldest washing processes and the jig frequently is called the universal washer. Up to about 5 or 6 yr ago most jigs in the coal industry washed the total mine output and feed commonly was from 4x0 to 8x0. But in the mid 50's the fine-coal jig employing a bedding material made its appearance in this country.

This type jig is an adaptation of the Baum-type unit with special features for treating fine coal. It differs from the regular Baum unit in having a permanent bed covering the screen plate and in the method of removing refuse. One type employs sized feldspar as a permanent bed and a second relies on plant refuse from the coarse-coal washer for bedding material.

In the conventional Baum jig for coarser coal, the entire bed moves horizontally over a perforated plate to the end of the washing compartment. At this point stratification has been accomplished and a separation is made by cutting the bed at the proper level to obtain the desired clean product at the top and refuse at the bottom.

The fine-coal jig removes refuse in a different manner. Refuse is hutched downward through the screen plate on which the permanent bedding material is retained.

The feldspar jig is built with washing compartment widths ranging from 3 to 7 ft in 1-ft increments. Lengthwise it is split into three 36-in cells, each completely isolated below the screen plate from the adjoining one. Resting on the screen plate is the permanent bed of feldspar which varies in depth from 3 to 7 in.

When ⅜x0 coal is fed to the unit, 2½x¾ feldspar is used for the bed and ⅝-in round perforations in the bed plate. This combination lets the refuse material pass through while retaining the feldspar. If larger coal is treated, plate perforations are larger and the bottom size of the bedding material is increased.

The first cell hutch is primary refuse, second and third are refuse or middlings. Third-cell hutch product, and in some instances second-cell, may be recirculated to the feed to maintain sufficient bed when reject volume is not extremely high.

Capacity under normal conditions is about 1 tph feed per inch of washing compartment width. The feed must be reduced somewhat if the reject percentage is extremely high or if the separation is very difficult. Feed can be increased if conditions are the opposite.

Clean coal overflows a weir at the end of the last cell with the water.

In most instances the top size of the feed is ⅜ in but has been as much as ¾ in. Tests on a unit treating ¼x0 Washington coal showed recovery efficiencies as high as 97.4% for plus 48M when operating at or near 1.60 gravity.

The fine-coal jig using a bed of plant refuse was developed in 1955 for processing Midwest coal. It has a cell compartment 2 ft wide and 3 ft long, giving 6 sq ft of bed area. Capacity varies from 2.5 to 4 tons per square foot of area and depends on the characteristics of the coal being washed.

It is reported to offer the following advantages:

1. It is a conventional piston-type jig using plant refuse as bed material.
2. The reject gate is similar to a modern Baum jig. The bed is controlled by an automatic float also similar to that in a Baum jig.
3. It is highly adjustable.

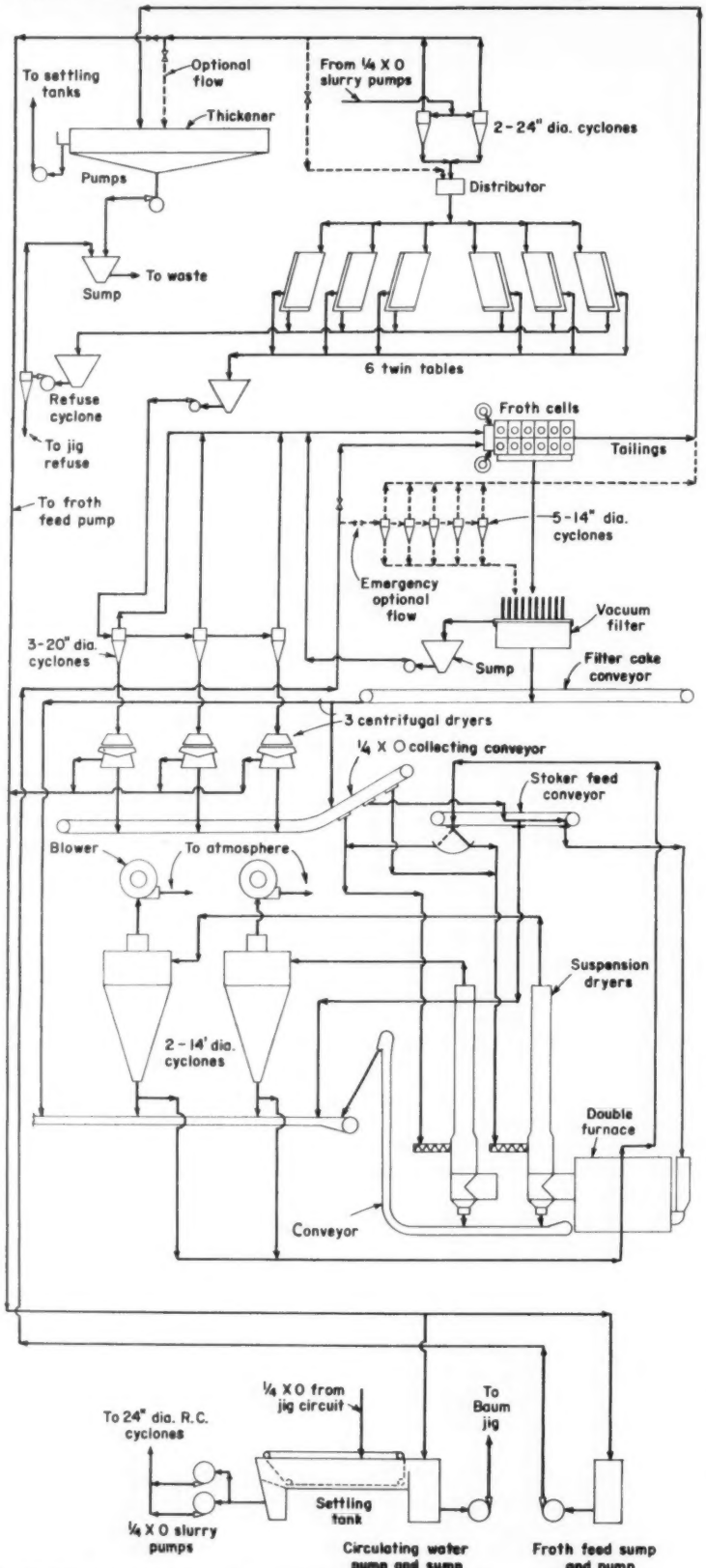
This type of unit has upgraded a raw product with 38 to 40% ash to a clean product with 8 to 10% ash on a dry basis at one operation. At another plant two units process 25 tph of feed containing 25% ash and yield a clean coal with 11.9% ash on a dry basis.

## Air Cleaning

There are several features that distinguish air methods from those using water. For instance, air is compressible and although the same principles apply as in wet units some special problems are present.

A distinct advantage cited for air

## *Fine-Coal Treatment and Water Handling*




**CYCLONES** deslime raw and clean coal in circuit including wet tables, flotation cells, vacuum filter and heat dryers. Thickener handles flotation tailings.

cleaning is the elimination of the need for drying, thickening and water-clarification equipment. But dust may become a problem and some method of keeping fine dust from the atmosphere must be considered in designing an air plant.

Most air methods rely on an upward current of air traveling through the bed to get the necessary mobility for proper classification. But they differ in methods of applying this air and in the method of removing refuse.

Air devices usually are grouped into jigs, tables or launders. Some units may incorporate features of one or more of these groups. Jigs employ a pulsated air current. Tables rely on riffles attached to the deck to divert refuse from the direction of flow of the clean coal. In launders, clean coal and refuse flow in the same direction, with clean coal being skimmed off the top and refuse removed from the bottom in several cuts.

A uniform feed is necessary to achieve good operation and cleaning results with air units. This can be achieved with a surge bin ahead of the cleaning units. Not only should the rate of feed be uniform, but segregation should be held to a minimum. If there is segregation of sizes or impurities, chances are that the cleaning unit will not operate efficiently. Segregation usually is caused by poor distribution of the raw coal in the surge bin. This trouble can be remedied by installing partitions in the raw-coal bins.

A number of other factors influence the performance of air cleaners. For instance, excess surface moisture can affect the performance of a cleaning unit. But the percentage of surface moisture that can be tolerated depends on the nature of the impurities. If the refuse is soft, flaky and disintegrates readily when in contact with water, the decking will blind even when a minimum of moisture is present. But if the refuse is hard and blocky, a higher percentage of moisture can be tolerated in the feed. Under favorable conditions, coal with 5 to 6% moisture can be cleaned by air. Sometimes the moisture percentage can rise to 10.

If there is a large percentage of dust in the feed, say 10% or more of 48M material, dedusting before cleaning may be desirable.

## Classifier-Type Cleaners

Classifier-type coal washers, both for coarse and fine coal, were first used in the anthracite region of Pennsylvania. From there use spread to the bituminous fields.

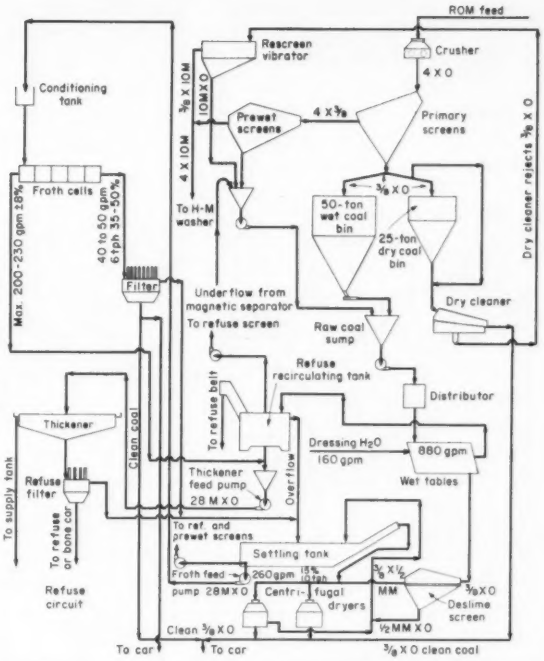
Types include the hydroseparator (upward current) and hindered units, such as the hydrotater.

The principal features of the hydrotator are a revolving agitator with four or more arms, each with nozzles inclined downward. Water flowing out of the nozzles strikes the bottom of the tank and deflects upward. Water is pumped from the upper level of the tank back through the agitator.

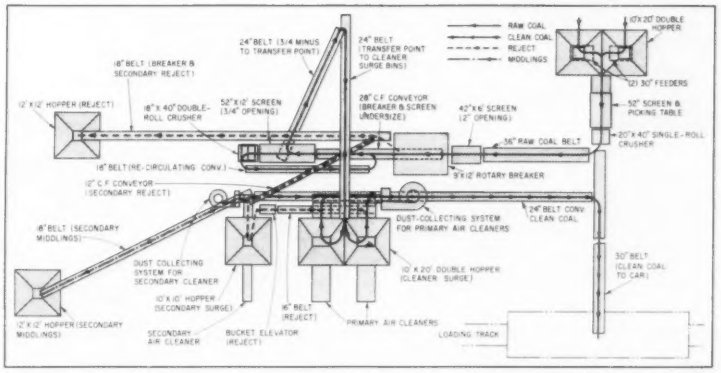
Fine coal feeds continuously into the top of the vessel. Some particles immediately go into suspension and are circulated with the water to form a medium, which makes possible the separation of the larger sizes.

## Launders

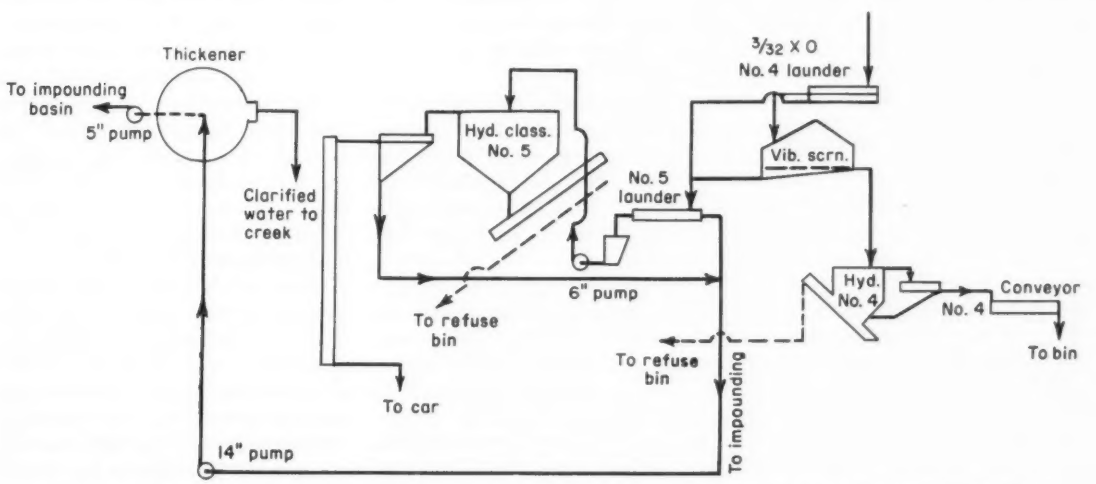
Launders employ a flowing current of water in a channel to accomplish separation of coal and refuse. Bed density increases from top to bottom and refuse is drawn off the bottom of the flowing stream. A fine-coal launder differs from a coarse-coal one in the number and type of boxes used. For example, a fine-coal system may employ as many as six units arranged one below the other. Discharge from the boxes of one launder falls directly into the launder below. Good operation of a



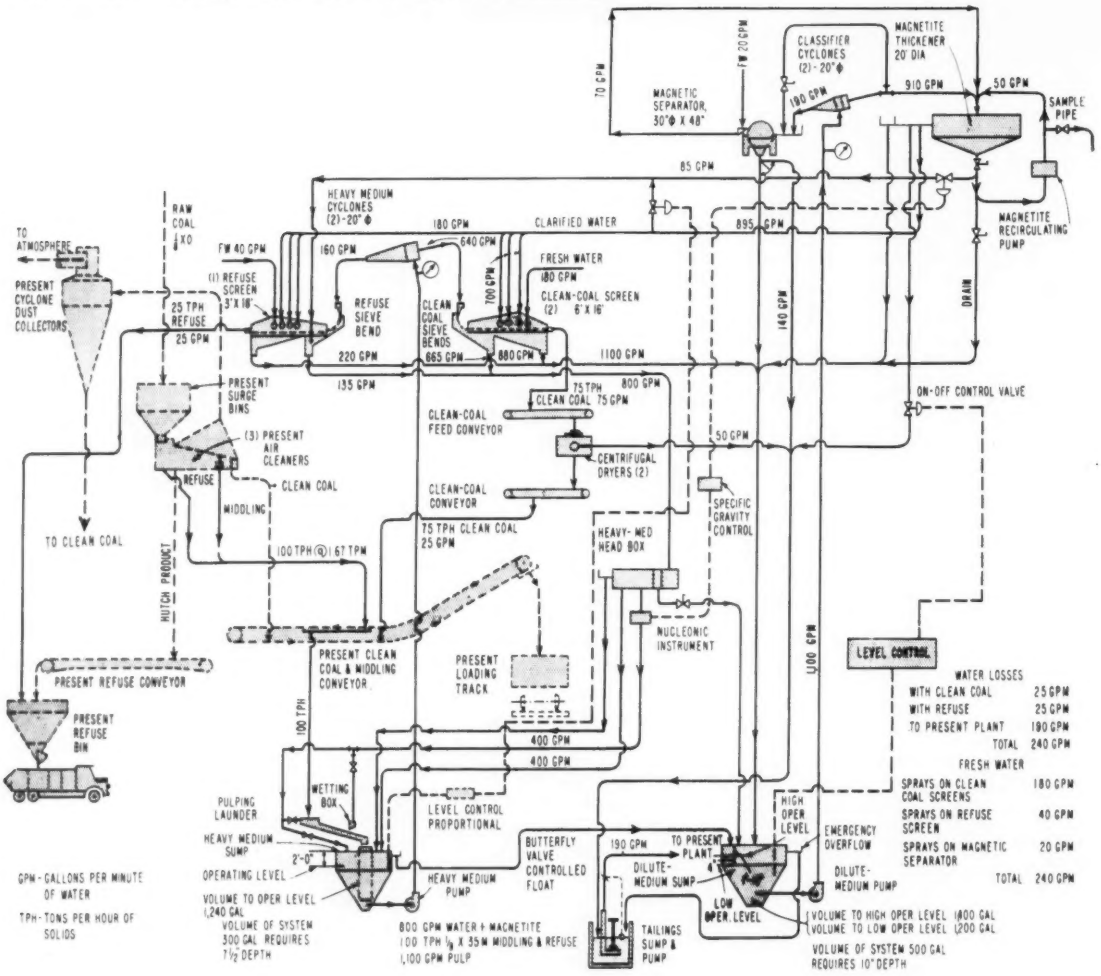

**FLEXIBILITY,** total cleaning and water conservation mark plant with wet and dry tables, flotation cells and centrifuges. Thickener and vacuum filters close the water circuit.




**TWO-STAGE AIR CLEANING** plant processes feed which is broken to 5/8x0 by crusher and rotary breaker. Main plant covers only 1,500 sq ft of space. One man oversees all plant units.




**LAUNDER SCREENS** size 3/32x0 to provide Buck No. 4 feed to hydrotator and Buck No. 5 to hydrotator-classifier.




**HEAVY-MEDIUM CYCLONES** with automatic nucleonic density control process ⅛x0 middlings and refuse from air cleaners. Bent sieves ahead of vibrators help remove magnetite from clean coal and refuse.

launder depends either on maintaining a fluid bed to permit the heavier material to work down through to the bottom of the launder for removal, or controlling the velocity of the stream.

## Heavy-Medium Cyclones

Heavy-medium cyclones have proven themselves as a new tool for precision washing of fine coal down to 35 or 48M. Among the advantages of these units are high cleaning efficiency at lower specific gravities, low plant construction costs because of less space requirements and ability to maintain cleaning efficiency with wide variations in the volume and quality of the feed. Furthermore, operating manpower requirements are low and maintenance costs are not expected to be more than that for an average fine-coal plant. Day-to-day cleaning results are reported to be uniform, varying only with the inherent ash of the raw coal.

The cyclones in service at two plants in this country have a diameter of 20 in and clean ⅜x28M and ⅛x0 with most of the 35Mx0 removed by air tables. Washing gravity is 1.40 and is controlled automatically.

A typical washing circuit includes heavy-medium cyclones, pumps, stationary and vibrating screens, centrifuge and density control. Equipment recovering the magnetite includes a pump, classifying cyclone, magnetic separator and settling cone or thickener.

One plant reports life of a washing cyclone at 124,,000 tons, or 1.1¢ per ton. But redesigned replacement units are expected to last four times as long. The heavy-medium pump maintenance cost was 7.6 mills per ton. Cost of the original wire cloth on desliming, clean-coal rinsing and refuse-rinsing vibrators was 3.8¢ per ton of raw coal, but changing to wedge-wire type on all but the refuse unit has reduced this cost to a minimum. Bent-sieve cost has been 0.6¢ per ton of raw coal.

Grade B magnetite which has 90% passing through 325M is used in the cyclones. Magnetite consumption at one plant is 2.12 lb per ton of feed.

Magnetite recovery is a very important part of the heavy-medium circuit because of its high cost and its role in maintaining the proper specific gravity in the cyclone. Re-

clamation systems employed with heavy-medium cyclones recover magnetite in two stages. The bulk is extracted from the clean product by bent-sieve stationary screens which receive the coal directly from the washing cyclones. Underflow from the sieves flows directly to the heavy medium sump.

These bent sieves have a screening capacity per unit of surface area between 10 to 100 times that of a vibrating unit. Furthermore, blinding is said to be less of a problem because separation is at one-half the opening size. Cost of operation is restricted to wear of the sieves and thus is lower than a vibrating unit for this service.

As a bent sieve wears, the diameter at which the cut is made does not increase as with a conventional screen, but becomes smaller. At the same time capacity decreases. By periodically reversing the feed and discharge ends, the size of separation becomes larger and capacity increases. For best operating results, bent-sieve screens should be reversed once or twice a week.

Sharpness of separation with a bent-sieve-type screen compares favorably with conventional screens. But overflow does contain a higher percentage of water, ranging from 40 to 60% of the original volume.

In the second stage the dilute remainder of the magnetite solution not removed by the stationary bent sieve is removed on the vibrator rinse screen and passed to the dilute medium sump. A combination of classifier cyclones and magnetic separator concentrates the magnetite for delivery to a thickener or settling cone. When the system does not require magnetite either of these units may be used for storage.

## Flotation

Recovery of the ultra fines, which in the past were discarded as waste, has increased greatly in recent years. There are a number of reasons for this accelerated growth. Probably the most compelling is the desire to increase profits by recovering a maximum of the coal brought to the plant and selling it at the best possible price. Other reasons pointing toward accelerated flotation growth are:

1. The drive for clean streams, which requires removal of extreme fines formerly bled to streams. Since these fines must be removed, it may prove more economical to employ flotation to produce merchantable coal while reducing the need for large settling ponds.

2. Air pollution problems in populated areas where high sulphur coal is burned in power plants. More grinding at the preparation plant may become necessary to liberate pyrite which then can be removed by flotation.

3. The possibility of new coal pipelines being laid to power plants, which will require fine grinding to sizes which are readily handled by flotation.

4. Manufacture of coke from a blend of cleaned fines. By grinding inferior coals and proper blending a suitable product can be made for pelletizing. Binders can be added to make a coke with superior strength.

5. Improvements in flotation techniques and reduction in cleaning costs per ton as the result of larger, automatically controlled circuits will make this method more attractive in the future.

Side benefits of flotation include lower cost of slurry handling, simplified water clarification and solution of air and water pollution problems.

For the most effective recovery, the top size recovered by flotation is around 48M, although some 28- and 10M material has been treated. When particles are below 325M, flotation becomes more difficult but is being done profitably.

In treating coal larger than 200M, pulp density should be about 20%. When a cell is processing the extreme fines below 200M, pulp dilution should be high, in the range of 10%. In general, the finer the coal the more dilute the feed should be.

The type of coal to be mined and the mining methods influence the percentage of extreme fines produced. Special attention also should be paid to refuse that can be expected in the plant feed. For instance, fine clay or material that tends to form slimes can cause trouble in the cleaning circuit.

Among the other items which must be considered in operating a flotation installation are the size and shape of the particles, the specific gravity of the material, pulp density, rate and uniformity of feed, reagents, rate of froth removal, pH of water or pulp, the presence of dissolved salts, and the flotation circuit itself.

More than 50% of all flotation units have gone into service in the past 5 yr. Of the 40 odd flotation circuits installed in the past 3 yr the most common are simple single banks of machines containing four to six cells each. In many instances plant waters with 5 to 15% minus 48M solids feed directly to the flotation units without conditioning or thickening. But dilution may range from 3 to 25% solids by weight. Natural dilutions are seldom altered for flotation treatment. And it is reported that the more dilute slurries often give the best over-all results.

Since flotation supplements other cleaning processes for coarse coal, the portion of plant feed flowing to the flotation cells is comparatively small, ranging from 4 to 10%. In tons per hour, feeds vary from 7 to 250.

Ash in the feed varies from plant to plant but averages about 20 to 25%. Clean products have ash contents from 2.5 to 10% and ash in the tailings ranges from 60 to 80%. Costs of flotation are reported to range from 5 to 50¢ per ton.

Chemicals used for flotation include straight alcohols, which serve as both collector and frother, and heavier fuel oils alone or modified with a frother. Full, or nearly full volumes of the most selective reagents, added initially to obtain the fastest possible flotation rate make for the best results.

Where alcohols alone are used, consumption commonly is 0.1 to 0.3 lb per ton of feed. Where reagent mixtures are required for heavier collecting, average consumption varies between 0.5 and 1 lb per ton of feed. In the heavy-oil process 20 lb or more of heavier oil is needed.

Because of the extremely wide range of particle size in the feed to flotation units, some major problems may be encountered. For instance, when 20Mx0 at 15% solids feeds to flotation units, the fines float rapidly so that only coarse coal is left in the later stages of the circuit. As a result, dilution is low and reagent

concentration too weak for effective recovery of the coarse fraction. Even with stage addition of reagents, best results are not always obtained on this size range of feed. For this reason, it sometimes may be advantageous to separate the feed at approximately 48M.

In addition to the foregoing more or less standard practices, flow procedures may be varied to meet a particular problem. For example, at an Ohio property 6% of a 2,000-tph feed leaves the plant as drag-tank overflow and flows by gravity to a pond. A barge-mounted pump picks up the settled solids for delivery either to a storage area or a flotation plant operating independently of the main cleaning plant.

The flotation plant operates 24 hrs per day, seven days a week. Independent operation makes it possible to control the tonnage and density of the pulp to suit the flotation process. Further, the plant can be started or stopped at will whenever adjustments are desired.

Offsetting these advantages is an extremely fine feed which averages about 70% minus 325M and has 35% ash. The feed also contains considerable coarse coal which is kept out of the flotation cells by screening over a 2.5-mm bent-sieve screen in closed circuit with a small ball mill.

Underflow from the screen is automatically diluted to the desired density and pumped to six 14-in cyclones. The overflow from each cyclone feeds a bank of cells. The underflow passes to a spiral classifier, products of which are treated separately as follows: overflow in a cyclone-type cell and underflow in a modified cell which is narrower, shallower and operates at a reduced speed of 175 rpm. Thus this plant operates by splitting the feed into three sizes, each of which is treated in a different type of cell.

## Dewatering and Rinsing

Removing water from fine coal is a major problem and must be considered an individual problem for each plant. Among the major devices for dewatering fines are fixed sieves, bent sieves, vibrators, launders, centrifuges and filters.

Two major functions of these devices are (1) primary dewatering ahead of mechanical or heat dryers, and (2) removal of extreme fines and water for treatment in a separate circuit, for refuse dewatering and for medium recovery.

High-speed vibrators lead in primary dewatering or rinsing of fines ahead of other units. Vibrators have a high dewatering capacity per unit of screen area and usually are installed with deck horizontal or inclined slightly upward toward the discharge end.

To get maximum performance from vibrators, coal should feed uniformly for the full screen width and a bed of proper thickness should be formed as quickly as possible and maintained over the entire screen surface. Dams across the screen at intervals from the middle to the discharge end retard the movement of coal and thus help promote water removal. Recessed pools on the lower deck in conjunction with sprays provide a means for repulping the coal as it moves along the screen and thus aids in removal of extreme fines.

Mechanical dewatering processes usually yield two products: the dried coal and the underflow or effluent. Each of these may follow a variety of routes, depending on the type of coal and degree of drying required.

## Centrifugal Dryers

Units commonly available for mechanical dewatering by centrifuging usually are grouped as follows:

1. Vertical units with transporting facilities.

2. Vertical units without transing facilities and relying on water or vertical vibration to move the coal. Handling coal up to 1¼ in, units using vertical vibration recover 98 to 99% of the coal with a minimum of degradation.

3. Horizontal units with vibration, which also handle up to 1¼ in coal with similar results.

4. Horizontal solid-bowl type. Recovery of ⅜ or ¼x0 is 95% or greater.

Today, centrifugal equipment can handle coal up to a top size of around 2 in and down to a fraction of a micron, depending on the type of unit and how it is employed. The increase in top size to 2 in from the ¼ to ½ in that prevailed for many years reflects the introduction of equipment employing principles of feed introduction, bedding, travel across the screen surface and discharge which reduce coal breakage and degradation to very-low figures.

In addition to drying, centrifugal machines may provide other benefits. Scroll- and gravity-discharge units, for example, where no bed is formed on the screen, have been installed specifically to reject high-ash fines in addition to drying, thus accomplishing a limited type of impurity removal by throwing out, say 8- to 28M material.

Where the specific objective is drying, however, centrifuges normally would not be employed for the coarser sizes, say above ¼ to 1 in, since conventional or specially designed dewatering screens can provide acceptable surface moistures. However, if a centrifuge is considered necessary for the finer material, certain types also can handle up to 2-in top size, and thus might obviate the need for a screen installation in addition to the centrifuge, especially if tonnage is low.

Relatively new, therefore, is the centrifuging of coal over ¼ to ⅜ in size. Centrifuging of coal under that size goes back many years, and in addition to the usual equipment employs the solid-bowl unit. A basic element of this unit is a solid rotating bowl in the shape of a truncated cone. Inside and running at a slightly different speed is a helical conveyor shaped to follow the contour of the bowl. A stationary pipe introduces feed into the conveyor hub. It flows out through ports into the bowl proper. The solids are moved to the wall of the bowl and along the wall to the discharge at the small end through centrifugal and spiral-flight actions. Effluent is discharged through the large-end bowl head.

A predetermined volume of liquid is retained in the machine for adequate clarification. Filter media, cloth or screens are not required and separation of solids from water is by centrifugal sedimentation.

An advantage cited for this type of unit is ability to introduce rinse water to facilitate elimination of very small (200M) high-moisture fines. These fines are induced, by

# Operating Data On Plants Using Flotation For Recovering Fine Coal

| Company Location | Feed TPH | Feed % Sol. | Feed % Ash | Feed Type, Size Coal | Feed GPM | Clean Coal Conc. % Yield | Clean Coal Conc. % Ash | Flotation Cells | Reagents Used | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| West Virginia | 36 | 13 to 14 | 15 | -28M | 1000 | 65 to 70 | 7 | 2 Banks of 6-66″ x 66″ | Alcohol | |
| West Virginia | 25 | 20 | 23 | -35M | 500 | 65 to 70 | 5 to 7 | Roughers, Two 3-cell 66″ x 66″; Cleaners, Two 3-cell 66″ x 66″ | Fuel Oil & Alcohol | Pumper Cells Used |
| West Virginia | 7 | 20 | 19 to 20 | -28M | 150 | — | — | 4 - 56″ x 56″ in series | Alcohol | |
| Ohio | 15 | 10 | 20 | -200M | 800 | 75 | 6 | 2 - 3 cell 66″ x 66″ | | |
| Virginia | 200 to 250 | 6 | 20 | Tiller & Jawbone Seam -50 mesh | 8000 to 9000 | 72 | -5 | 8 Banks of 6 - 66″ x 60″ x 29″ Total 48 | Alcohol | Recovering 160 to 200 Tph of 4.9% Ash Coal |
| Virginia | 44 | 7 | 11.5 | -28M | 2500 | 85 | -5 | Two 6 - cell 66″ x 60″ | Alcohol .2 lb/T of feed | |
| Pennsylvania | 40 | 18 | — | -35 x 200M Anthracite | — | 65 | -13 | 6 - 66″ x 66″ in series | Kero, Pine Oil | Refuse Ash = 57% |
| West Virginia | 30 to 40 | 6 to 7 | 30 | -28M | | 70 to 80 | 5 | 2 Banks of 6 - 66″ x 66″ | Alcohol | |
| West Virginia | 60 | 5 | — | -48M | 4500 | 90 | 5 | Four 5 - cell 66″ x 66″ | Alcohol | |
| West Virginia | 25 | — | — | -28M | — | — | — | Two 4 - cell 66″ x 60″ | Alcohol | |
| West Virginia | 60 | 5 | — | -48M | 4500 | 90 | 5 | Four 5 - cell 66″ x 66″ | Alcohol | |
| Ohio | 60 to 75 | 18 | 13 to 20 | -25 x 325M Pgh. Seam | 1300 | 50 | -10 | Roughers, Nine 3-cell 66″ x 66″; Cleaners, Nine 2-cell 66″ x 66″ | Fuel Oil & Alcohol | Pumper Cells Feed Rougher Conc. to Cleaner |
| West Virginia | 63 | 9½ | 10 | -60M | 2400 | — | 2.5 | Roughers, Two 6-cell 66″ x 60″; Cleaners, Two 5-cell 66″ x 60″ | Alcohol | |
| West Virginia | 40 | — | 20 | -28M | 2100 | 80 | 5 | Two 5-cell 66″ x 60″ | Frother 77 | |
| West Virginia | 26 | 6 | 20 | -½ mm | 1600 | 90 | 7 | Two 4-cell 66″ x 60″ | Alcohol | |
| West Virginia | 84 | 8 | — | -48M | 4200 | 60 | 8 | 20 - 66″ x 66″ | Alcohol | Tails 68% Ash |
| West Virginia | 8 to 10 | 6 to 7 | 24 | Poca. Seam -50M 42% - 200M | 450 to 500 | 70 to 80 | 5 | 4 - 56″ x 56″ in series | Alcohol 10cc per min. | Tails 58% Ash |
| West Virginia | 8 to 10 | 6 to 7 | 24 | Poca. Seam | 450 to 500 | 70 to 80 | 5 | 4 - 56″ x 56″ in series | Alcohol | |
| West Virginia | 15 | 6 | — | Poca. Seam 48 x 0, up to 70% -325M | 1080 | 70 | 7 | 6 - 66″ x 66″ in series | Kero, & Pine Oil | |
| West Virginia | 10 to 15 | 10 | 22 | Poca. Seam 30% 28 x 200 70% -200M | 250 | 70 to 80 | 7 | 5 - 56″ x 56″ in series | Alcohol | Tails 85% Ash, Filter Cake 22% $H_2O$ |
| West Virginia | 15 to 17 | 15 | 20 | Poca. Seam -28M | 350 | 70 to 80 | 5 | 1 Bank 6 - 56″ x 56″ | Alcohol | Second Plant |
| West Virginia | 140 to 160 | 4-5 | 10 to 12 | Poca. #3 Seam -50 mesh 50% -200 mesh | 13000 | 70 to 75 | 4.5 | 16 Banks of 4 - 66″ x 60″ Cells +32 High Intensity Conditioners | Fuel Oil Only | Phase Inversion Process |
| West Virginia | 30 | 4-5 | 20 | -28M | 2400 | 70 | 5 | 3 Banks of 4 - 66″ x 60″ Cells +3 Conditioners | Fuel Oil Only | Phase Inversion Process |
| Pennsylvania | 30 | 4-5 | 20 | Pgh. Seam -28 mesh | 2400 | 70 | 10 | 3 Banks of 4 - 66″ x 60″ Cells +3 Conditioners | Fuel Oil Only | Phase Inversion Process |
| Pennsylvania | 20 | 6 | — | Pgh. Seam -200M | — | — | — | One 5 Cell 66″ x 66″ | | Phase Inversion Process |

**How the Percentage of Minus 200M Material Affects the Final Moisture in Centrifuged Coal**

| Percent −200M In Coal | Moisture, Dewatered Coal |
|---|---|
| 3.0 | 5.0 |
| 7.5 | 10.0 |
| 14.0 | 15.0 |
| 21.0 | 20.0 |

**How Flow and Size Affects Surface Moisture of Dewatered Coal**

| Size | Surface Moisture | Remarks |
|---|---|---|
| ¼ × 0 | 7% | Centrifuge, super fines wasted |
| ¼ × 0 | 13% | Centrifuge, super fines in filter cake |
| 14M × 0 | 20% | Vacuum filter cake only |
| 28M × 0 | 22% | Vacuum filter cake only |

the introduction of the rinse water, to go out with the effluent instead of the coal. And because of the fact that the solids content of the effluent is small, it also is noted that, unless there is a high clay content, the circuit can be closed with this unit alone in many instances. If clay content is high a special bowl-type unit, known as a polisher, provides the extra capacity and separation ability to facilitate circuit closing.

What type of centrifugal unit to use depends on the amount and type of fines, including ash content, and the final moisture desired. Centrifigual units frequently are employed to reduce the load on heat dryers, and here the goal is a moisture content as low as possible consistent with cost of centrifuging, including any coal losses that may be incurred. A second goal is handling as much coal as possible in the centrifuges, thus cutting heat-dryer load in a second direction.

In jigging, say, 5x0, the ⅜x0 underflow from the dewatering screens, unless destined for further treatment, normally would go to a boot, settling tank or similar device where the water content would be reduced. Thus, it would not be a target of the solid-bowl centrifuge, since a major characteristic of the solid-bowl machine is its ability to handle large quantities of water—up to 60 to 75% of the feed. If large quantities were not encountered the regular machine would normally be the more economical.

An example of where the solid-bowl machine would fit in and simplify the circuit is in table washing of, says, ⅜x0 coal. In such a circuit the coal could come off the table directly into the centrifuges and then go directly to the final heat dryers if such were being employed.

If desired, the solid-bowl machine, unless rinse water is being used to eliminate them because of ash, as previously noted, can recover fines down to 10 to 12 microns in size. Overall, the unit, operating on ⅜- or ¼-in coal with not over 10% minus 200M, can cut final moisture to 7 to 8% with a recovery of better than 95% as a general rule. Ability to handle wide variations in feed size, consist and moisture content is cited as another advantage of the unit. Because it can handle large percentages of water, no prethickening of the feed is required.

The solid-bowl centrifuge also is about the only centrifugal machine that can go down into the extreme-fines area—under approximately 28M. As an example, where cyclones, seldom under 8 in, are used to recover coal from circulating water down to 250M, the underflow is an excellent feed for solid-bowl equipment. With the average 28M feed, it is possible to attain a cake moisture of 15%, with some exceptions depending upon the type of coal feed to the unit. Final moisture, however, is dependent to a considerable extent on the percentage of minus 200M material in the feed, as shown in the accompanying chart.

In contrast to up to 75% water for the solid-bowl filter, screen-type centrifuges operate better with not over 25 to 40% moisture in the feed which, depending on the particular operation, may require preunloading on a screen or other device. One manufacturer describes the ideal feed for his centrifuge as ⅜-in "predewatered on a ½-mm screen." In this unit, the coal is fed down to the bottom of a vertical basket. This basket is oscillated to help the coal climb to the top where it is discharged. The wedge-wire basket walls are coated with a bed of coal. This, it is noted, reduces friction between coal particles and also between particles and basket, and thus cuts degradation to only a few percent. Oscillation also is said to keep the bed open and free-draining. Low power and long basket life are claimed.

The normal screen opening for fines is 162 mm (2½ mm for stoker), but work is being done on reducing it to ¼ mm to keep more fines in the centrifuge circuit and reduce the load on other equipment. At the same time, work is also being done to open up the screen where it is desirable to reject fines because of high ash when handling a feed that has not been previously scalped.

Because leaving the fines in reduces centrifuge capacity and results in an increase in moisture in the final product, they may be processed separately. If a ⅜x0 product is processed, compared to ⅜x½ mm, the capacity of the centrifuge may be reduced from, say, 70 to 80 tph to around 40, while moisture may go up 1 to 2 percentage points over the 5 to 6% with ½ mm removed.

If complete recovery of ½-mm. or similar size is desired, it may be processed in flotation units, with the cleaned coal going, for example to a solid-bowl-type polisher. Tailings might be fed to thickeners and settled by flocculation if a pond was not available, with the thickener underflow becoming feed for a vacuum filter.

Partial recovery of the fines might be accomplished by use of a cyclone as in an accompanying flowsheet. The cyclone underflow becomes feed for a solid-bowl machine with effluent to a thickener followed by a vacuum filter, cake going to refuse. In this circuit, principal dewatering to 5 to 6% is done in an oscillating centrifuge.

Dewatering of stoker and larger coal is a reflection, as noted, of the introduction of new types of units, such as, the oscillating. In these, bedding on the screen and slow-speed operation (280 to 320 rpm, with 380 to 420 for minus ⅜ or ¼) contribute to negligible degradation, while surface moisture is reduced to 2 to 3% or less. Recovery

normally is 98% or better with both coarse and fine feed.

## Heat Drying

Heat dryers achieve surface moisture reduction by heat exchange between hot dry gases and moisture on the surface of the coal particles. There are a number of types of heat dryers available, each of which employs different principles of operation. Some, for example, employ mechanical means to transport coal in the drying chamber, others use high velocity air, gravity or a combination of the various methods to move coal. Some dryers push the hot air through the systems, others work under negative pressure and thus draw the gases through an exhaust fan.

An ideal heat dryer should provide ample hot air at the proper temperature and the coal should remain in this air only long enough to have the surface water removed. The dryer should be able to handle a large volume of coal with a comparatively wide size range. Simplicity of control and economy of operation also are important.

Gases leaving the dryer must be hot enough to prevent condensation of water vapor before departure. And sufficient heat must be supplied to overcome losses from the dryer to the surrounding air.

The final surface moisture desired depends to a degree on how much dust can be tolerated. As the percentage of ultra fines increases, the dust problem increases. As a consequence, the suggested or recommended moisture on the heat-dried product varies according to the percentage of ultra fines present.

Some commonly accepted values for dryer products are 2% surface moisture for ¼x0 centifuged coal without filter cake, 3% for centrifuged coal with filter cake and 5% for filter cake alone.

Types of heat dryers used in the coal industry are:

1. Fluid-bed, in which the coal is dried in a reactor in a fluidized state. A constriction plate separates the reactor into two compartments, a fluidized drying chamber and a combustion chamber which provides the hot drying gases. Hot air rises through the plate to the drying chamber and fluidizes the bed of coal. Wet coal is continuously fed into this bed.

On entering the bed at temperatures ranging from 775 to 1,100 F, the hot gases cool almost immediately to the bed temperature of about 150 to 160 F. On leaving the bed, the gases pass to a dust recovery system and then leave the stack at 140 to 150 F. Moisture on the feed coal usually runs 18 to 22% for steam coals and 8 to 14% for metallurgical coal.

The dryer sizes the feed at about 28M, with the smaller product recovered in cyclone dust collectors and the remainder in the bed overflow or discharge. The two dried products combine for loading. Exhaust gases may be passed through a scrubber with water and solids returned to the plant bleed.

2. Suspension type, in which wet coal is introduced into a column of upward flowing hot gases. Moisture removal is instantaneous. To reduce the dust nuisance, the system operates under suction or negative pressure.

This type is extensively used for drying fine ½ or ⅜x0 and has no lower screen-size or upper-moisture limitations. Coal is in contact with the hot gases about ½ sec and is in the system about 5 sec.

Drying gases enter the system at 1,000 F and leave at about 200 F. The source of heat is usually a spreader stoker, although pulverized coal sometimes is used.

Wet coal feeds continuously to the drying column. For coals with lower surface moisture a special screw feeder is employed. But when the feed is very wet, especially when it is a filter cake, some dried coal is recirculated to condition the wet feed so that it will be picked up by the hot gases. Under these conditions a double paddle mixer is substituted for the screw feeder.

To reduce degradation to almost zero, a coal trap has been developed for the suspension dryer. At one operation this trap recovers 75% of the dried product and the remainder is recovered by the high-velocity cyclone.

The vent fan discharges the gases to the atmosphere or to a wet scrubber if the plant location requires it. A wet scrubber may present a corrosion problem because of the presence of iron pyrites in the coal.

Another solution to removing fine dust is incorporating a dedusting system with the main cyclone. At one plant this type unit extracts minus 200M fines for burning in the furnace, thus producing a cheap fuel and at the same time dedusting the product.

3. Cascade, in which coal flows by gravity downward through the drying chamber in steps. Units may have revolving shelves or trays in a vertical cylindrical shell.

4. Screen, which includes a decline reciprocating screen on which the coal travels and through which hot gases pass. Hot gases may be pushed or pulled through the moving bed. Originally developed for coarse coal, the design has been modified to serve also as a fine-coal dryer.

One unit has pulsated gases moving up through the bed, passing through a cyclone dust collector and then exhausting to the atmosphere. The dried coarser particles discharge at the front end of the reciprocating screen into a chute and the extremely fine particles are recovered in the cyclone. Both dried products feed to a dried-coal screw conveyor and then pass to a sealed collecting conveyor.

5. Conveyor, in which the coal is moved through a hot-gas chamber on a perforated carrying strand or a wire-mesh belt. One type provides two stages of drying with both up- and down-draft gas flows.

6. Rotary, with either inner and outer shells, or an outer shell with lifting vanes inside. Newer types are designed for outdoor operation and coal-dust firing.

## Filtering

Increasing emphasis on fine-coal cleaning, including the ultra fines, and growing pressure to eliminate stream pollution are contributing greatly to the accelerated growth of filtering. Continuous vacuum-type filters, particularly the disk-type, lead in this service but some plants employ a solid-bowl centrifuge, known as a polisher, for this job.

Continuous vacuum filters include:

1. Disk type which has a number

of disk-shaped filter leaves rotating on a shaft. Each disk has a group of sectors which are covered by the filtering medium. As these disks rotate through the tank containing the solids-water mixture, negative pressure or suction is applied. Filter cake forms on the disks and the filtrate passes through to an outlet. As the disks approach scrapers, compressed air inflates the sectors. Thus the cake needs only a nudge from the scraper to be removed and discharged to a conveyor.

A number of factors influencing cake moisture with disk-type units are:

1. Size distribution of the solids, particularly the percentage of minus 200 to 325M material, and the ash content of the 200M coal which reflects the slime content. Slimes block the filtering medium, resulting in a wet cake and low capacity.
2. Cake permeability.
3. Wetting agent concentration, if used.
4. Filtrate visocity. If the circulating water could be maintained at about 80 F, a material reduction in final cake moisture is possible. By closing the water circuit this temperature can be approached. Final cake moisture will be lower and the need for thermal drying may be eliminated or materially reduced.
5. Characteristics of the coal.
6. Inherent moisture in the coal.

Among the other factors influencing the final cake moisture are the air rate per unit of filtration, pressure drop across the cake, drying time, cake thickness and filter medium. Among filter media, for instance, cotton will yield cake with 1.4 to 2.7% lower moisture than 60x40M stainless steel, but this is offset by the considerably higher filtration rate of the screen media.

How well a filter removes solids depends on the particle-size distribution, solids concentration in the feed, filter-cake thickness, cycle time and filter medium. Bridging of the filter medium is a major factor in solids removal. Since the cake itself is a very efficient filtering medium, bridging reduces the rate of passage of solids. Bridging is facilitated by a higher solids concentration in the feed, proper cake thickness and proper cycle time.

Total solids recovery in one pass through a disk filter is reported to be 93% or more. When the minus 200M in the feed is 50% or less, recovery is 99% or better. Recovery of minus 200M ranges from 87½ to 98% and averages over 97% when this fraction is less than 50% of the feed.

Since the filtrate generally contains from 200 ppm to 3% solids it can be recirculated without causing solids to build up in the system.

Most disk filters operate without agitation of the tank. In some instances an agitator in the base of the tank may be used to keep solids in suspension and prevent accumulation on side walls.

A number of new filter mediums have come into use as replacements for cotton. Among these are nylon, Saran, polyethylene and stainless steel.

2. Drum type, usually with an outside filtering surface. Basic design includes a compartmentalized cylinder rotating on its axis and partially submerged in a tank of slurry. The outer surface of the cylinder is divided into shallow pans or sections running the length of the drum. The filter medium is placed in these pans by sections or panels.

Feed enters the tank in which the drum rotates and slurry level is maintained at constant height. Separation of solids and liquid is by changes in air pressure plus a scraper as in the disk filter.

3. Horizontal type, which is a continuous vacuum unit rotating in a horizontal plane around a vertical axis. Within the past several years it has been introduced to the coal industry for dewatering fragile coal.

Coal feeds to the filter in two stages, the first being a charge of coarser plus 28M material which forms a 3-in layer. Then a second layer of cyclone underflow provides a seal layer over the filtration area. When the revolving pan reaches the discharge end, a 24-in scroll removes the cake and discharges it to a conveyor. Before receiving a fresh charge, the filter medium passes through a clean-out area.

At one plant the moisture on the filtered coal varied from 14 to 16.75%, depending on the size consist of the feed.

To enable any type of vacuum filter to perform most efficiently, slurry should be fed uniformly. Automatic feed-flow control is used to advantage at one plant to get a full filter cake at all times, prevent recirculation of solids, relieve the operator for other duties 90% of the time and attain uniform cake moisture. Differential probes in the underflow sump, conditioner and filter tub control valves, which in turn control slurry flow.

## Flocculation

All slurries are not readily filterable or can be filtered only at a slow rate. In some instances, these difficult slurries can be made filterable by flocculation.

For many years starch, lime and alum have been used to speed settling in thickeners and as aids in filtering. In recent years a number of new synthetic flocculants have become available. These new products are reported to be more versatile in that they continue to give good flocculation as the solids content increases.

Flocculation is the process of agglomerating extremely small particles or colloids into larger sizes, thus making a larger effective size for settling and filtering. Since larger particles fall faster in a liquid than smaller ones, increasing the particle size by flocculation considerably speeds the settling rate. As a result, thickeners can handle great volumes of slurries.

An added benefit of flocculation is that filters perform better. Without flocculation the extremely fine particles frequently blind the filter, resulting in a wet cake and low capacity.

Most flocculated particles can be broken up by shear forces and, as a result, filtering efficiency decreases. This particle degradation can result from pumping the flocculated solids. If, for example, the flocculated solids are degraded by pumping to filters, the floc can be easily reformed by adding a small quantity of the agent at the feed to the filter. If solids are not flocculated ahead of the filter, the reagent can be added directly to the filter feed to get the benefits of a flocculated pulp.

To avoid floc degradation it is important to add the flocculant at the proper point in a thickener. One type of thickener, for example, feeds the

slurry by either a pipe or launder to the center well where it discharges against a baffle plate before dropping into the well. Tests with one flocculant showed that the best point to introduce it is in the well itself. Thus floc degradation by the force of the slurry striking the baffle plate is avoided.

Another type of thickener uses gravity feed from a sump and an underground line to the center well. Since there is no pumping and hence little turbulence in the line, the flocculant may be added at the sump as well as at the center well.

Most filters are fed by pumping the underflow from a thickener. If a flocculant is added to the thickener, some floc degradation will result from pumping. For this reason it may be desirable to add a small quantity of flocculant at the filter point feed.

In some instances filters are fed by gravity and the benefits from using a flocculant may be more fully realized by adding it at the filter.

Settling rates of 20 to 30 ft per hour are being achieved at one plant at a cost of 3¢ per ton in a thickener feed containing 15% solids. Another plant achieves settling rates of 30 to 35 ft per hour at a cost of 6¢ per ton. To maintain 5 to 7 ft of clear water in a secondary thickener, treating cost at a third plant is 1½¢ per ton of fines.

## Desliming

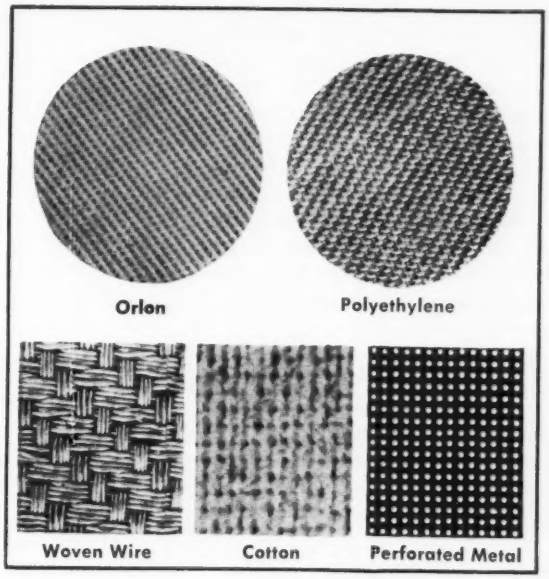
Removal of slime, a suspension containing 50% or more minus 200M material, is desirable to prevent loss of equipment capacity as well as to aid in pollution prevention. The most common method of desliming is by classification in water.

Wet classifiers fall into two groups: hydraulic, which are hindered-settling devices; and nonhydraulic, which are sizing classifiers.

Air units also may be used for desliming. One type employs air currents with velocities that will carry away the fine particles from a stream of coal. A second group employs centrifugal force similar to the air cyclone.

An added starter for desliming is the pneumatic separator which is now in service removing 48Mx0 from raw ¼x0. Operating at an efficiency of 92%, the unit also has a cleaning effect and does not tend to pick up pyritic sulphur or pure rock from the fluid bed. Air passing through the fluid bed picks up the 48Mx0 material which is recovered by cyclones in two stages. The 48x200M coal is recovered in the first cyclone for delivery to the clean coal belt and the 200Mx0 fraction collected in the second cyclone returns as fuel for the heat dryer.

**FILTRATION MEDIA** includes woven wire, synthetics, cotton and perforated metal. Woven wire handles easily filtered slurry. Synthetics are freer from nap than cotton and release cake readily. Cotton is less costly then synthetics but has lower resistance to acids and alkalies. Perforated metal passes a larger proportion of solids than other media but discharges cake readily.




Desliming may be accomplished on either raw or clean coal, depending on the method employed. Major advantages of desliming are:

1. Lower solids load in the circulating water, which results in a number of benefits. These include improved efficiency of separation in some cleaning units, reduction of colloidal clay in water adhering to the clean coal; and aid in washery water clarification.

2. Reduced load on dust-collecting facilities.

3. Potentially lower maintenance on pumps and pipes.

4. Lower ash in the clean coal or operation of the cleaning unit at a higher gravity, making possible greater recovery of coal while yielding coal with the same ash as an undeslimed coal.

5. Lower moisture in the mechanically dried coal and lower evaporating capacity required for thermal drying.

There are some disadvantages to consider in desliming, such as, loss of clean coal. Unless followed by some cleaning process, such as flotation, coal in the slimes is lost. Considerable money must be spent not only to desliime but also for subsequent treatment and handling.

The sludge pond is probably the most widely used method for slime disposal and is economical if it does not have to be cleaned out or if suitable land is available. When ponds are used, enough slime is withdrawn from the plant system to maintain the solids concentration in the circulating water at the desired level.

Before going to the pond, the slurry usually passes through a classifier device which makes possible recovery of coal. If there is little or no recoverable coal present in the slime, it may be advantageous to make a cut at 24M. Otherwise the cut may be made at 200M or lower.

There are some disadvantages of using sludge ponds, such as, large make-up-water requirements. Furthermore, pollution problems may be encountered if solids settle slowly or if rainfall is heavy. To minimize pumping costs it may be necessary to keep the concentration of solids in the circulating water at a higher level than desirable.

If considerable coal is present in the slime, it is usually desirable to send the plant bleed to a fine-size classifier, such as a cyclone. Concentrated solids may be returned to the fine-coal circuit, mechanically dewatered or sent to refuse.

Cyclone overflow might be processed further in a drag tank or a thickener. By adding a flocculant as the stream passes to the thickener, settling can be speeded. Clarified water from the thickener is recirculated to the plant and the concentrated solids pumped to a pond.

This system results in better control of circulating water, lower pumping costs, a clear effluent, reduced make-up-water needs, and a smaller settling pond.

As a further step in desliming, the thickener underflow may be pumped to a filter where the solids are dewatered and discharged to the refuse disposal system. The filtrate can be returned to the circulating water or to the thickener feed.

## Water Handling

Water handling is important in wet washing plants both from the viewpoint of providing a satisfactory fresh supply and clarifying process water for recirculation. Clarified water also contributes significantly to better unit efficiency.

Problems in water handling are:

1. Obtaining a reliable source of suitable water.

2. Reclaiming dirty water from the system and reprocessing it for recirculation.

Sources of fresh water include:

1. Man-made lakes, which are popular where rainfall is light and no surface streams are nearby, where deep wells do not yield sufficent water, and where the topoggraphy lends itself to dam construction.

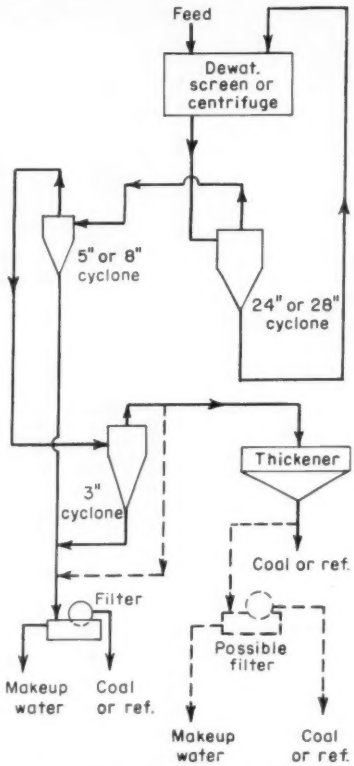
2. Deep wells.

3. Streams.

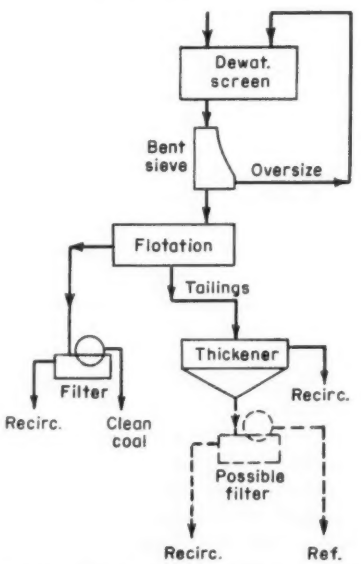
4. Mine water, which may be available in sufficient quantity and be of satisfactory quality to meet plant needs. One company pumps plant bleed into an abandonded section of the mine where solids settle out, leaving the clarified water available as a source of makeup water.

A fireclay bottom neutralizes any acidity the water may have gained in the plant circuit. The system also eliminates the cost of building and maintaining a settling pond.

When makeup water comes from deep wells, it usually requires no treatment and therefore can be fed directly to the plant circuit. But surface water coming either from streams or artifical lakes may be acid and at times may contain a high concentration of sediment. How much and what type of treatment is needed depends on the degree and type of contamination. If makeup water is fairly acid it may be desirable to neutralize to make it somewhat basic. Acid corrosion can thus be minimized.




**SOLIDS REMOVAL** in three-stage cyclone setup solves water clarification problem and may yield salable coal. Cyclone requires minimum of space.




**BONUS** of salable coal is major benefit of using flotation for water clarification. System is simple to operate and maintain, and may be less costly than others.

Even though makeup water may not be acid there is the possibility that minerals in the raw coal may cause an acid buildup in the circulating water. Regular checks of the pH therefore should be made when this possibility exists, such as, when sulphur content increases significantly. When acid water requires treatment, automatic equipment can do the job efficiently and economically.

Washing equipment, particularly jigs, usually perform better when water is supplied with uniform pressure. Head tanks with automatically controlled pumps are commonly employed for this service.

In any wet cleaning plant there is a certain volume of spillage of coal and water which must be handled. In plants designed with concrete floors this material is washed to drains during plant cleanup and then passes to a sump.

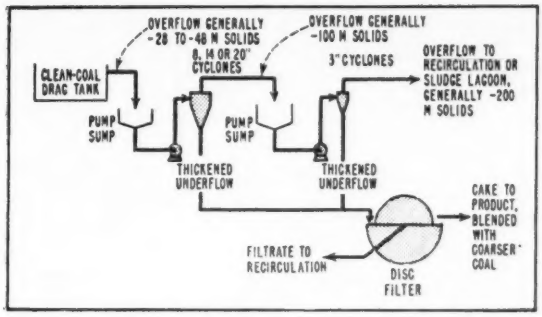
## Water Clarification

Increasing activity and interest in the processing of wash water are the result of stream pollution regulation, the desire to recover coal formerly lost to refuse and the need to prevent buildup of solids in the washing circuit. Solids buildup can, for example, affect the gravity of separation and efficiency of the washing units as well as cause degradation of fine coal.

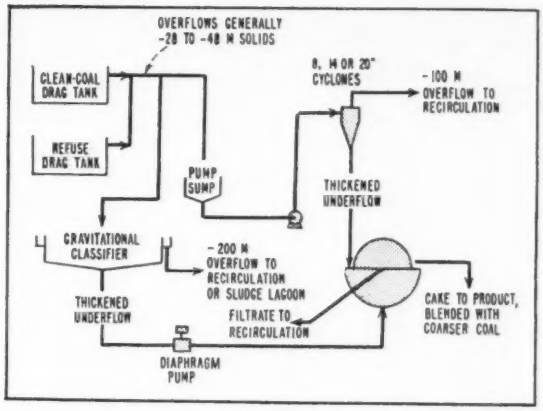
Closed water circuits have grown in popularity and frequently are the goal in water-clarification circuits. Major reasons for closing the circuit are: (1) elimination of solids discharge to streams, (2) conservation of water, (3) recovery of coal and (4) recovery of medium, such as, magnetite.

Since closing the circuit results in a buildup of slimes, it is necessary to remove a certain portion to maintain the solids content at a satisfactory level. Where the quality of the solids does not warrant installation of cleaning equipment or where large volumes of fresh water are required in the flow, bleeding of wash water to a settling pond may be desirable.

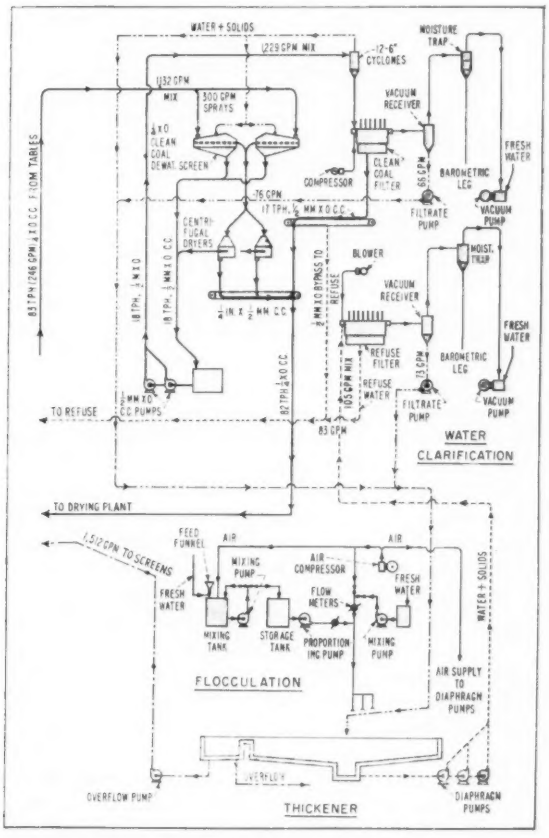
The sludge lagoon is sometimes considered as a foolproof method of



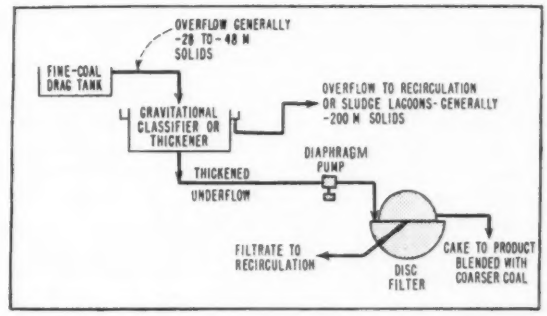

**VACUUM FILTRATION** with cyclones in two stages for preliminary classification of feed to the unit.



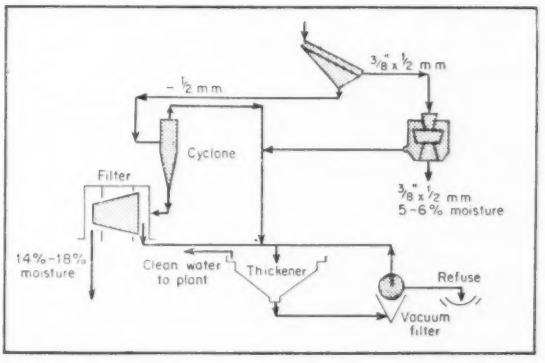

**VACUUM FILTRATION** with gravity thickeners and cyclones for preliminary classification of the feed before filtration.




**WATER-CLARIFICATION CIRCUIT** at one plant includes a combination of cyclones, thickener with flocculation and vacuum filters.




**VACUUM FILTRATION** with gravity classifier or thickener for preliminary classification of the feed to the unit.




**SOLID-BOWL HORIZONTAL CENTRIFUGE** supplements vertical unit in this circuit and handles minus ½mm. Cyclone, thickener and vacuum filter are important auxiliary equipment.

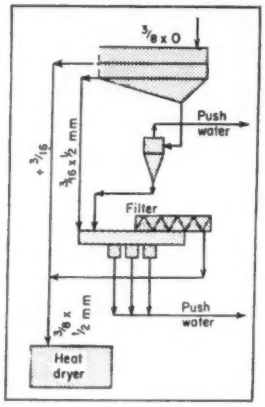
disposing of slimes. If the volume of slime is low and suitable inexpensive land is avalable, this method is very economical. But if a pond is employed it should be operated so that only clear water overflows.

Where bleeding is practiced to maintain a solids percent in the circulating water at a desired level, the slurry often passes through classifers. It is possible to make a separation at 200M or finer if desired. In some instances it may be desirable to make a cut at 24M.

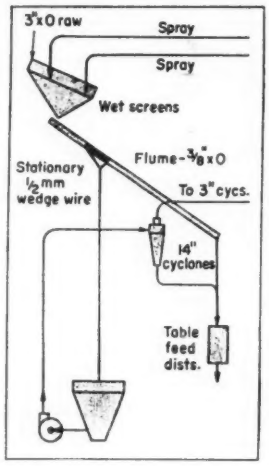
Some disadvantages of sludge ponds are the need for a large land area, higher consumption of fresh water and the hazard of pollution. Further, a plant using this system requires separate disposal systems for coarse and slime refuse. Solids in the circulating water may have to be kept at a higher level than desired to minimize pumping costs.

To get more rapid and direct control of circulating water, flocculation and thickening may be combined with bleeding. If the solids in the bleed contain recoverable coal, the stream can be first sent to fine-size classifier equipment, such as cyclones.

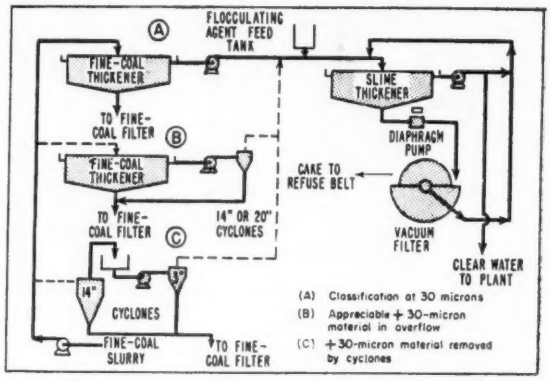
Recovered solids then can be re-




**HORIZONTAL VACUUM FILTER** in this fine-coal circuit is preceded by cyclone. Filter product goes to thermal unit for final drying.




**FIXED SCREEN** provides simplified desliming ahead of tables.




**SOLIDS REMOVAL** from wash water by flocculation and filtration, with variations to meet changing conditions.

turned to the fine coal circuit and the overflow directed to the thickener. To provide rapid settling in the thickener, a flocculant may be added. Clarified water from the thickener returns to the plant and the thickened sludge is pumped to a lagoon.

This combination of flocculation, thickening and lagooning eases control of circulating water, reduces pond requirements, yields a satisfactory clarified effluent and lowers pumping costs. But the problem of cleaning the settling pond may be present if additional land is not available. It costs more to operate this system than a simple sludge pond and two refuse systems are required for the plant. Additional operating costs are somewhat offset by lower pumping cost.

As a further step in water clarification, the thickened sludge may be pumped to a filter. The filtrate can be recirculated and the filter cake discharged to a conveyor.

Adding a filter to the clarification circuit eliminates the need for a sludge pond and problems associated with it. Pump costs are minimized and a positive control of circulating solids is obtained.

Other equipment for accomplishing partial solids removal before discharge to a disposal area includes conical or drag-conveyor settling tanks, hydraulic and nonhydraulic classifiers and cyclones.

Closed slime-removal filter circuits may be varied to meet specific conditions. Where a fine-coal circuit includes, for example, a gravity unit effectively classifying at 30 microns, the slime-filter circuit includes flocculation, thickening and filtering.

If considerable plus 30-micron material is present in the fine-coal thickener overflow, then 14- or 20-in cyclcones may be added to process the fine-coal thickener overflow. Cyclone overflow then is flocculated, thickened and filtered before passing to refuse.

In a third variation, plus 30-micron material is removed from the fine-coal slurry by two-stage cyclone thickening, with the second-stage cyclone overflow being processed by flocculation, thickening and filtering before going to refuse.

Three water handling systems based on filters for final recovery of solids where clay slimes are not excessive and a closed circuit can be obtained by filtration, or where the large slime fraction is bled to a sludge pond are as follows:

1. Cyclone classifiers in conjunction with gravity classifier or thickener delivering thickened underflow to a filter.

2. Cyclone classification in conjunction with filters. A two-stage system may be employed where minus 100M solids are too high in ash to be included in clean coal or all underflows from both stages are filtered as clean coal. Buildup of minus 100M in the circulating water is prevented in both instances.

3. Thickeners and cyclones for preliminary concentration, which makes possible better filter operation.

Systems combining water clarification and recovery of ultra fine coal formerly wasted are becoming more popular.

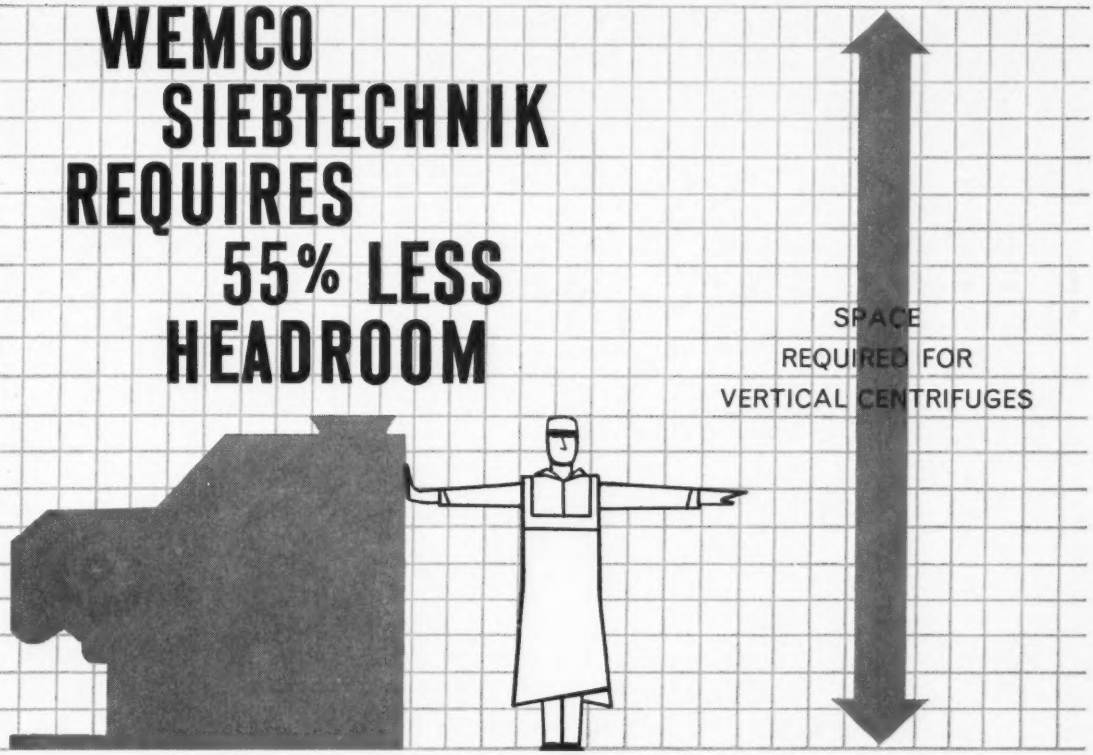
Flotation is experiencing growth in the field of ultra-fine coal cleaning and water clarification. An important benefit is a clean product which is better than when produced by filtration only. Furthermore, the flotation product always can be added to the clean coal but the product of filtration only may have to be discarded.

By removing the clean coal from the material formerly sent to waste, flotation decreases the volume of reject that must be handled. While the total cost of cleaning the extreme fines is higher than for coarser coal, it is less than for mining coal.

If total plant reject, for instance, at a 3,000-tpd operation is 20% and if 25% of this reject can be recovered from wasted fines, the total cost of the washed coal can be reduced. Assuming the total cost of washed coal to be $4.25 without recovery of ultra fines and the cost of recovering the ultra fines at $1.50 per ton, the total cost can be cut to $4.09. Aside from the potential profits, a flotation system may be simpler to operate and maintain than a solids-removal system alone.

The editors are deeply grateful to the manufacturers of preparation equipment for a portion of the material in this Operating Guide. Reprints of this Operating Guide are available and may be obtained as long as the supply lasts at a single copy price of 25c. Write The Editor, *Coal Age*, 330 W. 42d St., New York 36, N. Y.

# WEMCO SIEBTECHNIK REQUIRES 55% LESS HEADROOM

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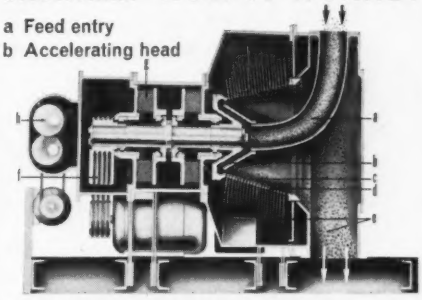

**c** Maximum dewatering by vibrating motion
**d** Easily accessible and replaceable basket
**e** Solids and liquids discharged separately
**f** V-belt drive
**g** Main mechanism and bearing housing
**h** Vibrating action generated by adjustable eccentrics

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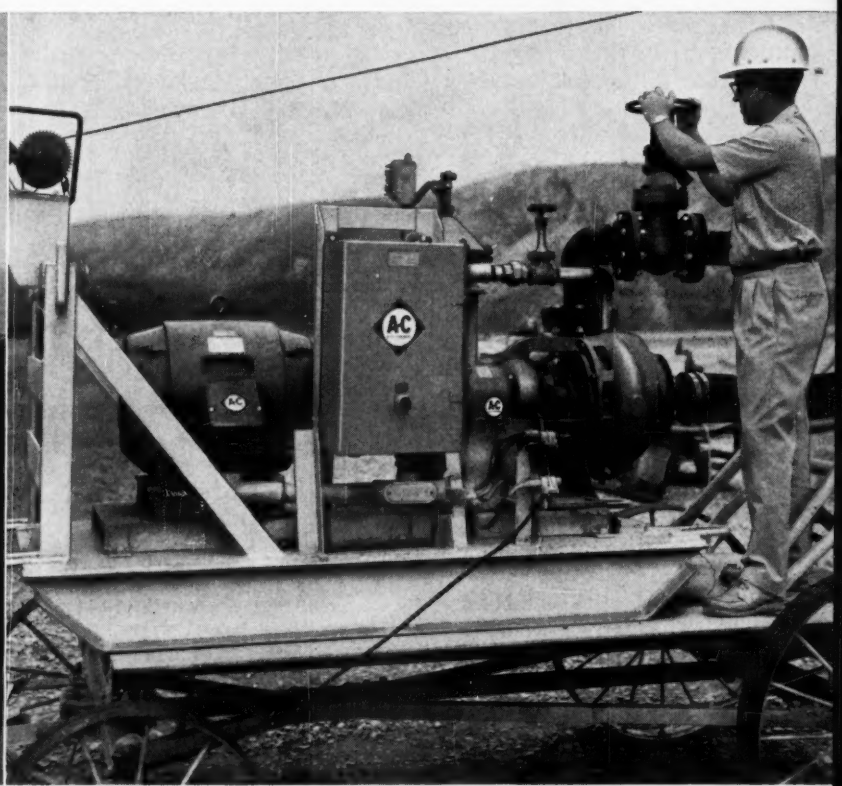
# ideas and news:



**Low-cost system will automatically correlate coal-loading data:** This data-handling system will automatically weigh bulk coal shipments and transmit invoicing data to a central billing office for a midwestern coal producer. The system will effect substantial savings in manpower. It was developed by Allis-Chalmers through its exclusive SYSTEMATION service.

**Allis-Chalmers portable pump gobbles up water, stacks up savings:** This portable pump is used in a strip-mining operation to clear flooded pits. It is equipped with a 40-hp SUPER-SEAL motor, a 6 x 5 frame-mounted Allis-Chalmers pump, and a Size 3 weather-protected Allis-Chalmers motor control. Recommended by Allis-Chalmers to empty flooded pit area faster, this larger pumping unit requires no more total power than the smaller unit it replaced. And the SUPER-SEAL motor withstands weather, moisture and abrasives.

## Which of these productive ideas could be working for you?

A low-cost data-logging system. Open motors that shrug off moisture and abrasives. Power equipment designed for you. These examples demonstrate the extra value that is standard with A-C...the greater efficiency and added productivity which are yours when you buy A-C products, systems and services. Call your Allis-Chalmers representative for details on A-C "worth-more" features. Or write Allis-Chalmers, Milwaukee 1, Wisconsin.



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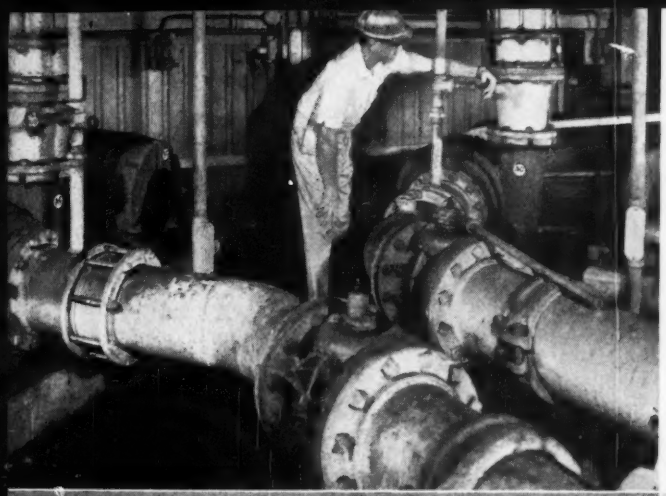
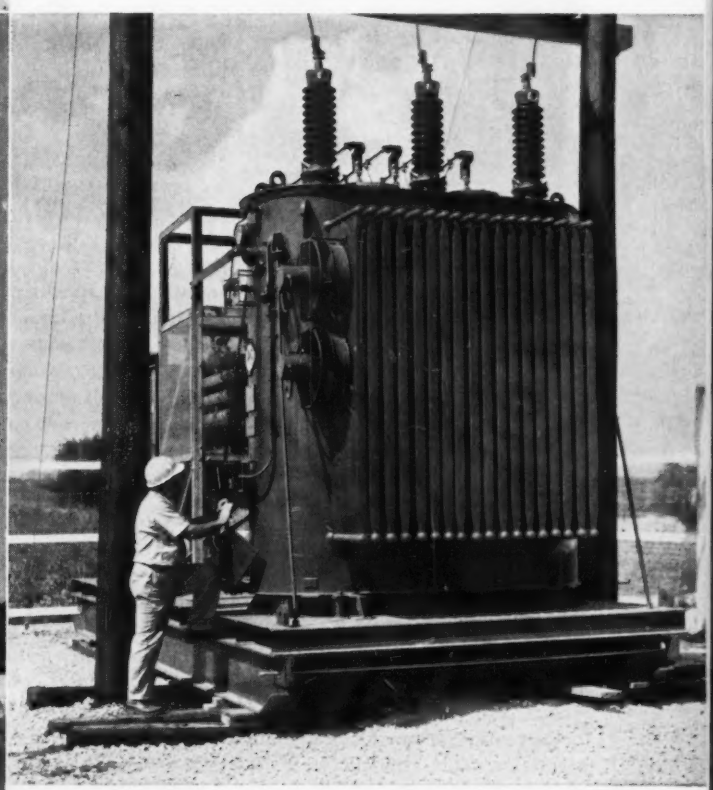


**Open motors like it damp and dirty:** In an Illinois coal-preparation plant, these 100-hp SUPER-SEAL motors are driving Allis-Chalmers 10x8 CW pumps that handle fine coal in suspension. Remarkable POXEAL insulation in these motors is impervious to moisture, dust and most contaminants. And because SUPER-SEAL motors are **open** motors, they offer a 15% greater service factor than totally enclosed units.

**Skid-mounted semi-permanent substation:** Built to move when operations shift is this transformer/circuit breaker unit. Skid mounted at the factory, this substation furnishes power for the shovel on the left. Transformer is dual rated 3750/4687 at 55°C rise. 4200/5250 kva at 65°C rise. The type OZ oil circuit breaker has 3-tank design to give absolute phase isolation — one faulted phase cannot affect other phases.

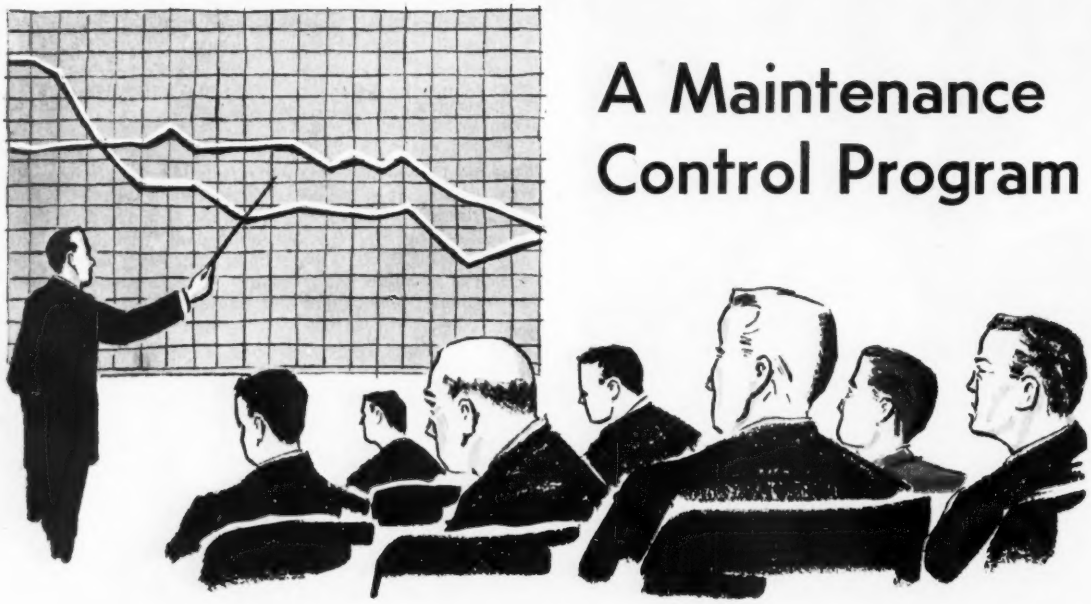


**Circuit breaker gets dragged around all day:** This A-C skid-mounted "breaker house" serves a 65-yd shovel . . . moves right along with it. Good example of Allis-Chalmers ability to meet customers' specialized needs. The oil-type breaker is combined with a current transformer and potential transformer on the specially designed skids.

**ALLIS-CHALMERS PRODUCTS:** Look to Allis-Chalmers for compressors; controls; crushers; earth-moving equipment; engines; generators; industrial systems; lift trucks; motors; pumps; rectifiers; **vibrating screens;** electrical generation and distribution equipment; tractors; transformers; unit substations; valves.

*Systemation* is an Allis-Chalmers servicemark.

# ALLIS-CHALMERS



# A Maintenance Control Program

A MAINTENANCE CONTROL PROGRAM establishes a systematic method for effectively planning, organizing and utilizing men, materials and equipment to keep the plants in good operating condition at all times and under all conditions as economically as possible. Preventive maintenance, on the other hand, is a sound, logical, tested system of planned maintenance to obtain maximum efficiency and production with existing equipment. It prevents breakdowns and shutdowns through systematic inspection of equipment, making adjustments and scheduled repairs before failure occurs, thereby preventing interruptions to plant operations. This article, which appeared in *Maintenance News,* a Westinghouse Electric Corp. publication, is essentially the description of how a preventive maintenance program was established, the reasons for its establishment and the results obtained.

The company studied and discussed here spends millions of dollars annually on maintenance. Your maintenance expenses may not reach this proportion but you will find a wealth of sound information that could improve your present setup.

## Top Management Action

Top management was concerned over the ever increasing maintenance costs and the lack of adequate budget justification for such costs. At the other end of the organization, the maintenance engineers had their problems. Each plant had a maintenance system of its own but no over-all standard program or method existed to prove to management the effectiveness of its operation. The pressure of keeping up with a heavy workload left little time to develop tangible data to support a presentation to management which would prove the value of the program or bring home forcibly the fact that something was wrong.

The organization and procedures department was authorized to make a preliminary survey of the maintenance function and to present recommendations for the development and installation of a full-scale maintenance control program.

The preliminary survey was started immediately. Extensive data was collected at the major plants and lesser detail was gathered at the smaller operations. The data was based on both physical inspections and the asking of a series of pointed questions on maintenance practices to which blunt answers were received.

The findings showed that, as a whole, maintenance work had not been placed on a planned and scheduled basis and that the "squeaky wheel" too often got the grease. There was no consistent system for assigning priorities to jobs. Manpower and material requirements were not estimated on a carefully planned work program but rather on the basis of recurring crises, emergencies and pressures.

Other specific findings were as follows:

1. Approximately 19 different work requests and work order forms were in existence.
2. Up to seven types of rush and emergency priorities were in effect.
3. Work was not performed in order of importance.
4. Poor cost records were in existence.

5. Advance daily, weekly or monthly workload planning was lacking.

6. Preventive maintenance was put into action on a somewhat impromptu basis and far from complete.

7. A backlog record of work by craft, number of hours or amount, and type of materials required to clear up such backlog was not being maintained.

8. There were few controls on the amount of new maintenance work to be undertaken, other than the availability of staff.

There was found, however, a great desire at all levels of the maintenance organization to cooperate with the survey and their willingness to participate in the development of a working system of preventive maintenance.

## Recommendations

On the basis of the preceding findings a report was prepared for management which recommended the development and installation of a complete maintenance control program consisting of six major phases:

1. Develop and install administrative controls, listing of routine jobs and work-order system.

2. Develop and install procedures for controlling and scheduling manpower, equipment and materials.

3. Develop a system of record keeping for plant use for filing, compiling and tabulating information to be used in analyzing and improving the maintenance function as it relates to (a) cost control, (b) improved preventive maintenance, (c) manpower and equipment requirements, (d) budget detail and (e) improved maintenance methods and techniques.

4. Develop standards.

5. Develop a system of materials control.

6. Develop a system of reports to the various levels of management to portray the status of the maintenance activity.

This was a team operation with organization and procedures department as the principal staff unit. The organization and procedure department worked with the line departments on all phases except No. 4 (developing standards), which was the responsibility of industrial engineers.

Before continuing, it might be well to define what a maintenance control is and to define the type of maintenance encountered at these plants.

A maintenance control program establishes a systematic method for effectively planning, organizing, and utilizing men, materials and equipment to keep the plants in good operating condition at all times and under all conditions as economically as possible.

At these plants there were two types of maintenance:

**1. Happening or breakdown maintenance**—This comprises failures and breakdowns to machinery and equipment during a scheduled production period at which time only the repairs necessary to get the equipment into production are made. This form of maintenance is very expensive, inefficient and precludes maximum production.

**2. Preventive Maintenance**—This is a sound, logical, tested system of planned maintenance to obtain maximum efficiency and production with existing equipment. It prevents breakdowns and shutdowns through systematic inspection of equipment, making adjustments and scheduled repairs before failure occurs, and thereby preventing interruptions to plant operations.


## Development of the Program

As a first step, successful maintenance programs were investigated in other companies and in other areas as to the procedures, forms, reports, techniques and the reactions of the men to such a system.

The survey team evaluated the acquired information in the light of their own requirements and used what they could. Forms, reports and procedures were designed to meet the requirements of a sound basic program consistent with the average plant maintenance functions.

**Equipment Record Cards** – A series of record cards was set up which provided identification for each item of equipment and for each major structural component:

1. A summary record showing the location of the item, nameplate data and other identifying characteristics.

2. The preventive-maintenance schedule pertaining to the item.

3. Its repair history.

To establish such a record, the following steps were necessary:

1. A complete physical inventory of all equipment for which the maintenance group had responsibility for maintaining and controlling.

2. Each such unit was assigned an identification number to facilitate location and enable foremen and workmen to readily identify an item for preventive maintenance purposes.

3. Provisions were made for the recording of breakdown data from the work order to the back of the equipment record card.

**Programming of Routine Jobs** – Routine jobs consist of maintenance work that is done on a regular periodic basis, daily, weekly, monthly, yearly, etc. They cover routine maintenance machine adjustments and repetitive jobs such as lubrication, operations of stationary equipment, clean up areas, etc.

Prior to the preventive maintenance program these routines were usually not recorded but were in the foreman's head. They comprised the basic work-load of the plant. All such routines were documented along with related data such as, hours per team, man-hours per year, crafts, season, weather, frequency, next due date, routine job number.

Routine work orders were issued to eliminate the necessity of repeatedly issuing individual work orders for jobs that could be prepared in advance. The work orders were then filed in readiness for their regular call-up date and when due, were incorporated into work schedules

through an orderly planned procedure.

**Requests for Maintenance Work**—are used to notify the maintenance department of work that has to be done. The request contains a description of the work to be performed and indicates the urgency of the request.

The foremen and maintenance supervisors use these requests for "costing" the job. The requests then serve as a basis for preparing work orders which are issued to the workmen with clear directions for the work to be done, the crafts, hours, amount and type of material, equipment, special tools or drawings required. The foremen at this stage also determine the priority of the job.

The request is a three part form. The original, the back of which is used to evaluate the request, and the second copy are sent to the maintenance dept. The third copy is retained by the originator for follow up purposes. The maintenance department returns the second copy to the originator after inserting schedule data of work.

**Work Orders** – Work orders are prepared on the basis of a foreman's prior estimate of the job as described above. There are two types of work orders for non-routine work:

1. Red colored work orders which are used for rush and emergency jobs.
2. Yellow colored work orders which are used for non-rush work.

In addition, the program provides for white work orders for routine jobs – details are derived from the original listing of routine jobs.

The work orders which are prepared by the maintenance scheduler or clerk, provide information to the leadman on what is to be done, location, names of men who are to assist him, the material and equipment requirements, the date and approximate starting time.

The completed work order provides historical data for determining cost, material usage, manpower and equipment usage, validity of foreman's estimates, factors causing delay and unusual circumstances.

**Work Scheduling for Future Weeks** – The scheduler, working from vacation schedules and schedules of regular days off, constructs an advance schedule of available man-hours by craft groups.

An important aspect of this schedule is that a reserve of man-hours is set up for rush work. This reserve is determined by experience—ratio of rush to non-rush work—and is subject to revision as more accurate recordkeeping helps the scheduler to better forecast rush workloads.

**Daily Work Schedule Prepared One Day in Advance** – Using the visible index (work order) file each day, the foreman reviews the workload scheduled for the week, selects jobs to be done the following day and prepares a simple work assignment sheet.

After reviewing these work assignment sheets for discrepancies, the scheduler releases them to the typist for preparation of the next day's schedule.

Daily work schedules must be flexible so that in the event of emergencies or inclement weather, changes can be made quickly and orderly. To meet these requirements the foreman prepares in advance rainy-day schedules which can be substituted for the regular schedule on short notice. Certain crafts are often underscheduled in anticipation of rush work. If it does not materialize, non-rush work is scheduled on a fill-in basis.

Changes, additions and deletions to the work schedule are made in red pencil on the original copy. At the end of the work day, reasons for the changes are reported along with information as to the end-of-shift status of work orders.

Four copies of the daily schedule are prepared for each craft:

1. Second copy for posting to bulletin board.
2. Third copy for craft group foremen.
3. Fourth copy to maintenance supervisor and the scheduler.
4. Original is sent one day later to the manager.

**Reports and Statistics** – Reports and statistics can be evaluated as to the effectiveness of the preventive maintenance program, equipment replacement needs, reduction in mechanical downtime, need for better standards and improvement of maintenance techniques. These include:

1. Daily schedule of maintenance work.
2. Maintenance workload for future weeks.
3. Maintenance program statistics.
4. Maintenance data for a variety of special reports.

## Installing the System

After the development of the basic system the survey team acquired desk space in the maintenance shop of one of the operations. They virtually lived at the plant installing the work-order system. The listing of routine jobs was reviewed, experiments were made with filing equipment, and foremen, staff people and maintenance schedulers were trained. Procedures were revised, the forms, schedules and reports changed to expedite processing, meet new requirements, and overcome unforeseen problems.

As in any new program the plan could only succeed to the extent that people can adjust their work habits, customs and traditions to the new situation. It was often necessary that they stop doing some things which they previously did and acquire new skills that they had to possess if they were to carry out their new assignments effectively.

At this crucial point the more progressive foremen came to the fore. They utilized the new tools and materially improved the capacity of their craft groups to perform a more comprehensive service with ever-increasing maintenance economies. Their results and success sparked a new co-ordinated effort which firmly established the effectiveness of the test installation.

The learning processes had been a two-way street in that not only the maintenance group but also the survey team had been taught some lessons:

1. Management must be sold in advance on the merit of the program and solidly back it during the critical installation stages if the benefits of a realistic program were to be achieved.

2. Future installations would require a more extensive and formal training program prior to installation to speed up the transition period from the old to the new program.

3. Never underestimate the potential of the low man on the organization chart. His reaction to the new procedures can make or break the installation.

On the basis of the practical experience acquired during the test installation the following developments took place:

1. A series of process charts were prepared outlining the basic program.

2. A "Forms Guide to Work Order Scheduling" brochure was developed and reproduced. The brochure provided detailed information about the use of each form designed for the system.

3. Temporary operating instructions were written to clearly and completely define policy and procedures to be followed.

4. A training schedule for foremen and maintenance schedulers was developed to outline the indoctrination procedures.

With this basic training data available, the team was ready to conduct indoctrination sessions on the theory, operation, objectives and potential benefits of the program.

The first group receiving basic indoctrination of the program was top management, consisting of the executive director, his staff, department heads and their staffs.

Three-day seminar-type indoctrinations were conducted for the maintenance supervisors and the maintenance schedulers. Two days were spent in theory and application and one day in actual review of the working installation. This gave the maintenance supervisors, foremen and schedulers a chance to participate in selling the program at their level.

Indoctrination sessions were conducted for the maintenance men. These sessions were 2-hr duration outlining the benefits of the program and detailing the responsibilities of the maintenance men for the operation of the system.

The survey team worked with plant maintenance and management on a continuing basis to help develop the listing of routine jobs, install the system, train the personnel involved and iron out any "bugs."

It might be of interest to note that outside of the survey team no special personnel were needed to install and administer the program. The organization's regular maintenance force was trained in the various aspects of the program. Some additional help and overtime was required during the initial stages. While the operation of the program is not without cost, nevertheless much of the cost is merely a transfer of previously existing clerical costs on a non-systematic basis to equivalent costs for a uniform systematic approach. Furthermore, any additional cost in operating the program amounts to only a small percent of the annual savings resulting from more efficient maintenance work. Savings estimated conservatively at 10% of total maintenance labor costs.

## Improved Management Effectiveness

The departments and plants benefited primarily through the provision of techniques for relating their organizational structures, numbers and types of personnel to the amount and types of maintenance work to be done, through improved manpower and equipment utilization resulting from the use of these techniques, and through the development of better managers at various levels responsible for maintenance work.

The following more specific benefits were a direct result of the installation of the maintenance-control program:

1. Clarification of organizational relationships and functions as they relate to maintenance resulting in the lessening of personality and jurisdictional clashes.

2. Provision of standards which, with the routinizing of various types of maintenance workloads, have made it possible for the plant to plan its day-to-day work, measure its effectiveness and program its future workloads.

3. Provision of data which can now be analyzed by those most familiar with the operation in the areas of (a) cost reduction through better work methods and techniques, (b) planning more effectively for the better utilization of new equipment, materials and proper size and flexibility of work force and (c) work scheduling which provides for work to be done in proper sequence of routine, rush and non-rush, and a steady flow of this work to workmen.

4. Establishment of standards by which to evaluate staff performance as it relates to maintenance.

5. Creation of an awareness on the part of many of the foremen and supervisors that in this era of technological advancement, tight labor market and sensitive labor relationships, much more than technical qualifications are required to direct the activities of maintenance groups, large or small.

Also recommended but not completely installed at the time the survey team's report was written was a maintenance - activity performance profile for evaluation of plant maintenance work. The adoption of a performance profile (performance standards) for maintenance work with possible supervisory incentives, such as, recognition of contribution to maintenance activity. This would help establish effective control over plant management and supervisory performance and foster a competitive spirit among plants. One key aspect to such a profile is the ratio of routine to non-routine work — a good standard is 70% routine and 30% non-routine. The greater the

number of justified routines, the better the preventive maintenance program.

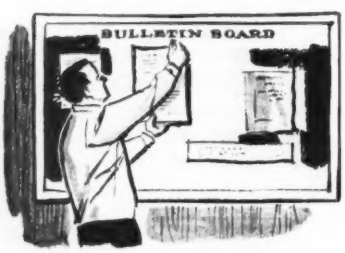
**Manager Level**—In the area of maintenance administration, a manager's performance would be judged acceptable if:

1. The ratio of routines to non-routines is at least 70% to 30%, respectively. Experience may prove that this ratio should be varied for particular plants and there is evidence that the justified routines continue to increase in relation to the non-routines.

2. The rush work is being reduced and the categories of "rush" are legitimate and not generated by whim and fancy, personal prestige, or just plain lack of planning.

3. There are actual dollar savings resulting from the review and analysis of routines and new techniques. Work methods are being developed.

4. Maintenance manpower is in balance with maintenance workload.




**Maintenance Supervisor and Foreman Level**—The maintenance supervisor would be evaluated on the same standard with important additions as follows:

1. The schedulers' functions are properly performed as they relate to (a) advance scheduling, (b) up-to-date and proper posting of daily schedules, work orders and equipment record cards, (c) up-to-date file and (d) requested statistics are readily available.

2. Time has been devoted to development at the foreman level. This could be in the form (a) that there are regular foremen's meetings at which problems are discussed and resolved, (b) that written recommendations and proposals resulting from these discussions are being made to the next level of management and (c) the productive output is meeting maximum requirements.

**Foreman Level**—Similarly, the foremen would be evaluated not only on their technical skills but also on their administration of the control program as follows:

1. There is evidence that systematic action is being taken on (a) cost reduction and (b) development and testing of new work techniques and methods.

2. Workload and types of work are being reviewed and analyzed to determine if the productive effort meets a fair standard.

3. Budget justifications for manpower, equipment and material are being prepared on the basis of the statistics available from the maintenance control program.

4. The maintenance control program requirements are met as evidenced by (a) schedules being made up in advance, (b) changes in the schedule are at a minimum, (c) work orders are carried into the field by the workmen and are properly processed, (d) required reports are prepared on time and (e) adequate information is presented to the plant manager on which decisions can be made.

5. Long range planning of the maintenance activity is taking place.

6. Improvement objectives for foremen, maintenance teams or craft groups exist in writing.

**Maintenance Personnel**—First echelon supervisors from leadmen to maintenance supervisors have received a new insight and a keener awareness of their responsibilities and the part they play on the management team. They more clearly recognize the potential savings out of expenditures of millions of dollars in maintenance costs which can be realized through the efforts of informed and progressive maintenance leadership. They feel they have been taken out of the category of "laboring foremen and production pushers." As they gain more experience in these areas, they recognize that they themselves must develop into managers—men who can be relied upon to supply factual information to management, develop new techniques and methods which will enable the department to exercise better control, enhance decision-making and institute improved operating procedures, all of which will assure a smoother functioning plant with ever-increasing attention to maintenance economies.

This program has necessitated that each foreman and supervisor re-evaluate his management skills. As a result, they have experienced a steady "grassroot" type of spreading interest in supervisory skills as they relate to communications, establishment of discipline, more productive work from the men, better selection of men and training techniques. The workmen, both skilled and unskilled have requested training sessions relating to the program and the management philosophy behind it.

This spreading interest in supervisory skills on the part of the maintenance force should be encouraged as it points to the revitalization of interest in their work and their personal progress in relation to it.

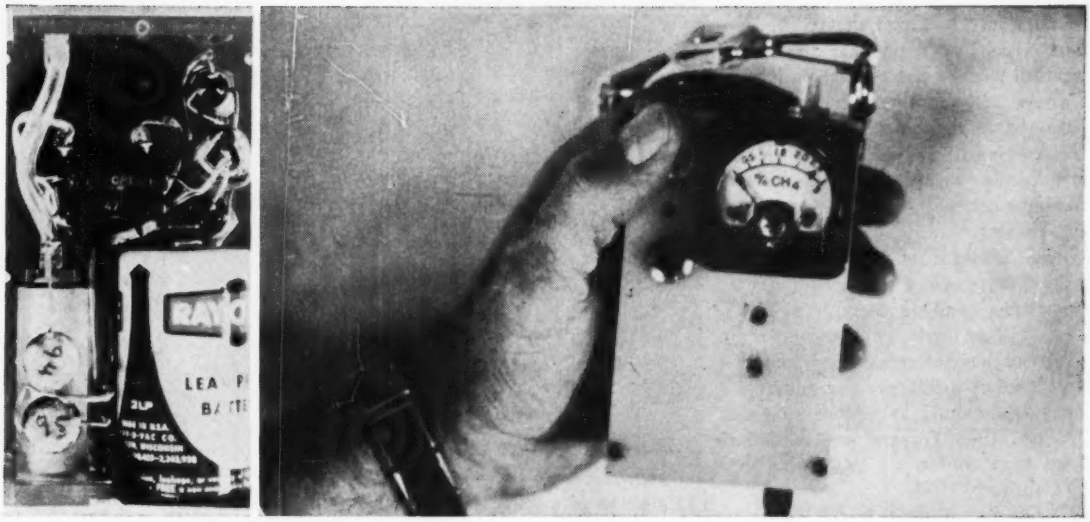
The maintenance supervisory staff have become more conscious of work measurement and the team found definite trends toward setting up empirical standards. As an example, weekly meetings with the foremen are held to discuss a predetermined group of routine work orders to evaluate the frequencies, time allowances, work methods and economic justifications. At these weekly meetings, maintenance supervisors screen and evaluate the routine maintenance work orders and classify the savings resulting from this scrutiny under the following categories:

1. Revision of frequencies or time allowances.

2. Revision of methods.

3. Revision due to physical factors.

The belief is that all maintenance forces should be encouraged to analyze, evaluate and experiment with the program developed to date. With the backing of their management and with their broad knowledge and experience on the job, they are in a position to develop new techniques and methods which will materially cut costs and improve the maintenance operation. There is practically no limit to the improvements, better maintenance practices and cost reductions that can be realized.



**MINIATURE** methane detector employs a bridge circuit to provide a signal for metering in the presence of methane. Elements in the detector require minimum power, permitting the use of a D-size cell as source of energy.

# Developments in Methane Monitoring

**D. H. Zellers,** Chief, Research and Development Section
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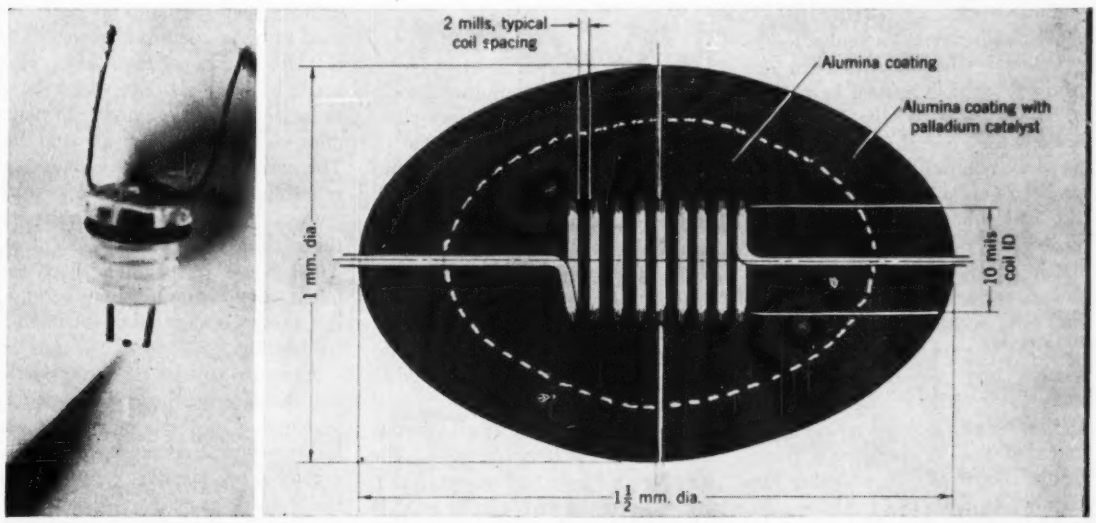
U. S. Bureau of Mines
Pittsburgh, Pa.

THE NEED for an automatic, constant-monitoring methane detector resulted from modern rapid extraction in gassy mines. Flame safety lamps and portable electrical detectors only give spot determinations and must be observed by individuals, usually at irregular intervals during the working shift.

Monitoring devices may be di-

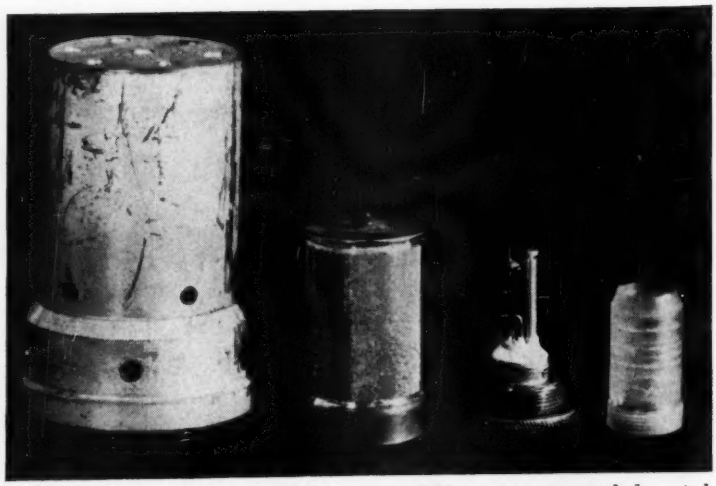
Abstracted from a paper presented at the 1961 National Safety Congress.




**PELLEMENT,** at left, is the heart of the miniature detector. Two of these are built into the device, one active and the other inactive to provide a reference. A bimetallic switch is actuated by heat produced at active pellement in methane.

vided into: (1) Those that continuously record methane concentrations but still require observation by individuals, and (2) those that sample methane and give a visible or audible warning or perhaps shut off electrical power or start up a fan when methane concentrations reach a predetermined level.

The Director of the Bureau of Mines, recognizing the need for an automatic methane monitor of the second class, invited representatives of instrument, electronic equipment, and mining machinery manufacturers; operators' associations; the United Mine Workers; and the Bureau to a conference in Pittsburgh in February, 1958.



**ELEMENTS** of monitor sensing head used in field investigations include switch and protective housing and gauze, before miniaturization.

## Requirements

The desirable features to be incorporated in an automatic methane-monitoring system were outlined by the Director as follows: (1) The system shall give a visible or audible alarm if and when the concentration in the vicinity of the sensor reaches 1.0 to 1.5% methane; (2) the system shall cut off all electrical power to the affected section if and when the concentration in the vicinity of the sensor reaches 2.0 to 2.5% methane.

The only restriction placed on the manner in which these two functions might be accomplished was that no ignition hazards were to be introduced.

The Bureau has subsequently established the requirements to be met by a manufacturer wishing to have a methane-monitoring system certified. These requirements are embodied in a proposed schedule which has not been published in its final form. Two preliminary drafts have been published in the Federal Register. Subsequent to each publication, a meeting has been held with interested parties who had submitted comments concerning this proposed methane-monitoring schedule as it appeared in the Federal Register. The schedule in its final form should soon be available.

At the time of the Director's conference, one manufacturer already had commercially available a device for cutting off electrical power at the source if a cable fault or a frame ground occurred. This device was readily adaptable to a methane-monitoring system. Another manufacturer had a similar device not fully developed. A third manufacturer had an approved methane alarm, which, with some modifications, could be incorporated into a monitoring system.

Several other manufacturers submitted prototypes of monitoring detectors which were examined and evaluated, but none of these have reached final development.

It eventually became evident that private industry either was hesitant or, because of current business conditions, could not afford to invest in the research and development of monitoring equipment. Consequently, the Bureau undertook the development of a suitable monitoring detector.

## The Pellement

In the Bureau's monitoring device, two elements, with well-known characteristics, were combined. One of these, which we call a "pellement," is a small catalytic mass which will oxidize low concentrations of methane. This element is mounted adjacent to the second element, which is a bimetallic switch such as that used in home-heating-system thermostats. The heat of combustion of the methane by the pellement is employed to actuate the switch.

The net result is a small, simple, inexpensive methane detector. The idea for this unit had occurred during experiments with a flame lamp in which a thermal switch was mounted. Subsequently, we learned that the idea was not original, for two patents had already been granted for a device employing these basic principles; one patent had been issued in this country and one in England—the latter had been granted to an Italian.

Although basically the Bureau's device is similar to those covered by these two patents, it differs with respect to the catalytic element referred to previously as "the pellement." This element presents a relatively new concept in the combustion of low concentrations of methane by catalysis. Heretofore, the catalysis occurred on the surface of spongy coiled platinum filaments; however, with the Bureau's pellements, coiled platinum filaments are used only as heating elements. The catalysis occurs on the surface of a small bead of alumina which bead so formed is impregnated with platinum and/or palladium as catalysts. The pellement oxidizes methane at a relatively low initial temperature (approximately 400 F) and gives ten times the life of a bare filament, 3,000 hours versus 300. Since the initial temperature need not be high, less energy is required to accomplish the heating.

As an example, a miniature methane detector has been developed in which two of these pellements are incorporated, one active and one inactive. The inactive pellement is made in the same manner as the active one except that it is not impregnated with the catalyst. Upon appli-

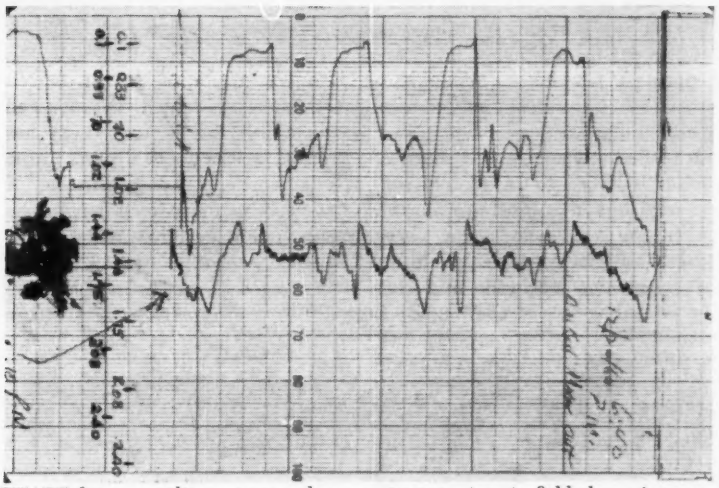
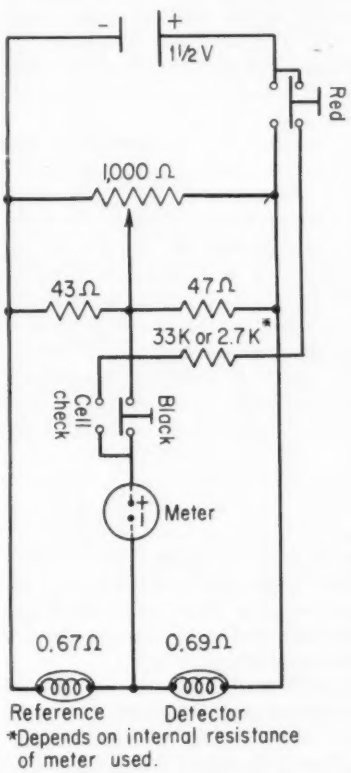


**CHART** from recording meter used on continuous miner in field shows increases in methane content at face whenever miner goes into operation.

cation of current to the bridge circuit, it is heated to the same initial temperature as the activated pellement, but it does not increase in temperature in the presence of methane because there is no combustion. The inactive element may be located in the same atmosphere as the activated sensing element or it may be housed in a cell containing fresh air, as it is in the case of the miniature detector. This detector is energized with one D size flashlight cell. The pellements in it are wound with .002-in wire and require a current of approximately 0.4 amp. Those used for the monitoring detector are wound with .005-in wire; consequently, more current (1.3 amp) is required to heat them to the threshold temperature. Although pellements made with 2-mil wire may function satisfactorily for the monitoring detector, those made with the heavier wire seem to be more practical because of their additional mechanical strength. However, it is essential that the power requirement be kept to a minimum, since that determines the size of the power source required.




**SCHEMATIC** of miniature detector shows bridge circuit and pellements.

## Operating Principles

In the course of our investigations, numerous examinations with regard to both sensitivity and simplicity were made of various basic principles used in measuring low concentrations of methane.

In the table following, from a paper by F. W. Pritchard, of Great Britain, are listed the approximate percentage changes in output signal that will occur in instruments using various principles if 1% methane by volume is added to the air passing through the instrument.

| | Percent |
|---|---|
| 1. Gas temperature above a flame | 16 |
| 2. Resistance of electrically heated filament on which methane is burned catalytically | 3 |
| 3. Volume of pressure change on combustion | 2 |
| 4. Density | 0.5 |
| 5. Refractivity | 0.5 |
| 6. Thermal conductivity | 0.2 |
| 7. Velocity of sound | 0.25 |
| 8. Viscosity | 0.4 |
| 9. Infrared transmission (20CM path 600 C–Black Body Source) | 0.3 |

Obviously the greatest degree of change is available if the methane is burned by an open flame. This principle was investigated, as already indicated, but it was shelved, at least temporarily, in favor of a device built on principle No. 2 because that one affords a much higher degree of safety.

In all field tests conducted to determine the performance and dependability of the Bureau's detecting device, methane recorders were employed. These recorders were developed at the Bureau using the wheatstone bridge circuit with pellement sensing units.

Preliminary field tests were first conducted at the Bureau's experimental mine under controlled conditions. Other tests were subsequently conducted at commercial mines located in Pennsylvania, West Virginia, and Indiana. From these field investigations, we learned the following: (1) The air flow pattern around a machine is very fluid; no homogeneity of gas-air mixtures can be expected; (2) methane can be expected to rise to the roof and flow in a thin layer along the roof—even opposing ventilating currents; (3) methane may be occluded in the coal and only liberated as the coal is broken down; (4) methane may also be liberated from the solid face and ribs, in some cases floor or roof; (5) ventilation constitutes the most important factor for reducing methane concentrations but often may be inadequate or neglected; (6) with relatively high rates of methane liberation, 40 to 50 cfm, one of the most effective means of delivering adequate air volume to the face with

continuous mining is with auxiliary fans and tubing; (7) the practice of piling coal behind a miner is an important factor in the restriction of air flow and consequently in the buildup of methane concentrations over the machine.

## Mounting on Machines

As for monitoring devices it was determined that (1) the detecting elements or sensors made with the catalytic mass and thermal switch could withstand normal shock and vibration when solidly attached to a continuous miner; (2) these sensors also functioned quite satisfactorily even in the presence of coal dust and/or moisture; (3) they did not shut off power except when sensing methane concentrations at preset limits; recording equipment used in conjunction with the monitoring equipment was an excellent tool for studying the adequacy of face ventilation and influence of operating practices to methane buildup.

The design of the machine dictates the location for the sensors. It was concluded that the sensors should be mounted as far forward and as high as practicable for adequate protection. No definite conclusion has been reached as to whether one sensor judiciously mounted will be adequate or whether in some cases two will be needed.

In the Bureau's investigations, two sensors were used; they were located from 7 to 15 ft from the face and from 12 to 18 in from the roof, depending upon the machine with which they were used.

Recent concern because of numerous reported face ignitions in coal mines has placed definite emphasis, and I might add, pressure, on the progress of methane monitoring in this country. The problem is recognized and also has been given consideration in other countries.

## Overseas Developments

In a paper titled "Recent Developments in Methanometry" by F. J. Hartwell, M. Sc., of Great Britain, which was presented to the Sixth International Conference of Directors of Safety in Mines Research at Verneuil, France, in 1950, various handheld detectors were described as well as a "Firedamp Recorder." The first model of this recorder was built in 1936, and many improvements were later incorporated. This instrument measures the pressure changes following combustion in two independently operated chambers. A pointer is linked to an aneroid cell and registers the pressures in the combustion chambers on a chart fixed to a clockwork-driven drum that makes one revolution in 24 hr. The recording is not continuous; a 36-milliliter sample is pumped into the combustion chamber and burned. The complete cycle requires 6 min, and by having the cycles of the two chambers staggered by 3 min, 20 independent analyses are made every hour.

A second recorder is also described in the same paper. It is the Ringrose methane recorder, a mechanized version of the Ringrose methanometer. The basic principle for that instrument is somewhat the same as that first described; that is, the instrument gives a measure of the difference in pressure that results when combustion of methane occurs. The Ringrose recorder gives one analysis every 6 min.

Another paper relating to methane monitoring in Great Britain, titled "A Recorder of Atmospheric Methane Concentration Based on a Butane Flame Lamp," by F. W. Pritchard and S. A. Phelps, was presented to the Tenth International Conference of Directors of Safety in Mines Research at Pittsburgh in May, 1960. In brief, a thermopile is placed above the flame of a safety lamp in which butane as fuel is fed at a constant rate for stability. The electromotive force generated by the couple is used to close a relay which can be employed to initiate any desired sequence of operation.

With further reference to British methanometry, a recently published article titled "An Acoustic Methanometer" describes a unit used successfully in Great Britain in conjunction with methane drainage. It measures gas concentrations in the piping system ranging from 40% to 90% methane. Developing a practical methane-monitoring detector on the acoustic principle may be rather difficult. Where the ratio of gas to air is only one to ninety-nine, the degree of change is extremely small, and the resulting unit will be very critical, particularly to foreign gases, water vapor, and dust.

Dr. Maas of the Netherlands, Department of Mines reports that a methanometer which is mounted against the wall of a roadway has been in use for about 8 years in the Netherlands. This is presumably a stationary methane recorder, for he states that it is too fragile and too large to be mounted on heavy equipment. As he points out, any such instrument can be modified to actuate a relay and give an alarm at any preset value.

The following is a very brief article in the November 4, 1960, issue of the South African Mining and Engineering Journal which gives some insight into what the Russians have accomplished in the field of methane monitoring: "Methane measuring stations in various parts of a mine feed information through the mine telephone network to a computer which programs the ventilation system — as methane builds up in an area, more air is automatically directed into the area, thereby diluting the methane. If the methane builds up to a dangerous concentration, the mine power system is cut off."

Methanometers built on seven of the nine principles (all but density and viscosity) listed in the table in Pritchard's paper, one based on the absorption of ultraviolet light passing through a methane-air mixture, and one that measures on a photoelectric cell the quantity of light emitted during the combustion of methane by a catalytic filament have been investigated, evaluated, or at least are familiar to those of us in the Bureau who have been involved in this problem. It is noteworthy that most of the successful methanometers and detectors for other combustible gases have been developed on the second principle listed, "Resistance of Electrically Heated Filament on Which Methane is Burned Catalytically." In most cases, the change in resistance that results from the combustion of the methane by a catalytic filament is employed to throw a bridge circuit out of balance. In the Bureau-developed detecting device, the heat transfer is used to mechanically actuate a thermal switch. The heat of combustion might also be used in conjunction with thermistors and thermocouples.

*(Concluded on p 96)*

## A Look Ahead

Although a number of the listed principles might be applied in the development of satisfactory laboratory methanometers, certain limitations preclude their successful application as methanometers intended for use in coal mines. The resulting unit would be too delicate, too critical, or too expensive.

A study is in progress to determine the component parts best suited to the Bureau-developed sensor, the best arrangement of these parts, and an ideal source of electrical energy. The last is relatively simple if alternating-current power is available but somewhat more difficult if the mine power is direct current. Fortunately, alternating-current power is becoming more available. However, since the proposed schedule 32 requires that the system shall function for a period of 4 hours, independent of the mine power, the most logical source of energy for powering the methane monitor seems to be a storage battery which can be floated on the line and thus kept at near full charge while power is delivered to the machine. The relatively new hermetically-sealed nickelcadmium batteries seem to offer the most nearly ideal source of energy.

Although a methane-monitoring system will not increase production other than by necessitating improved face ventilation and thereby preventing explosions, we have been encouraged by the reception our experimental monitoring equipment has received from those in the industry who have seen it. There seem to be many officials in the coal mining industry who feel that there is a need for an automatic means of determining the methane concentrations in the face regions. This is particularly true in the case of those using continuous mining machines.

Progress has been made, but the successful development of a complete methane-monitoring system is still not a reality. Furthermore, the Bureau-developed sensing element is not considered the ultimate in design and operation. There may be better ways of achieving the desired results. Considering all of the technological advances that have been made in recent years in this country, surely other satisfactory equipment can be developed. The Bureau will gladly cooperate in every way possible.

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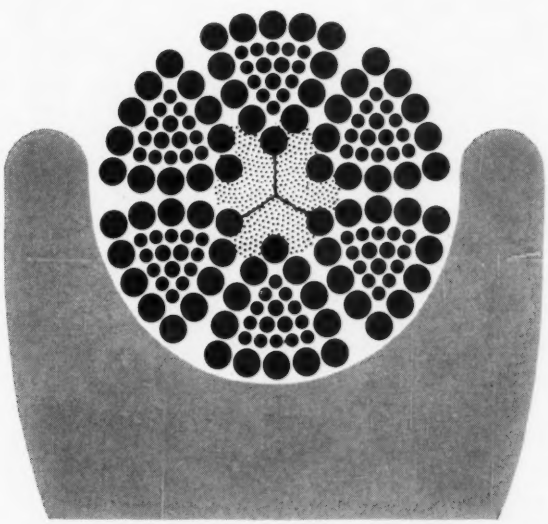

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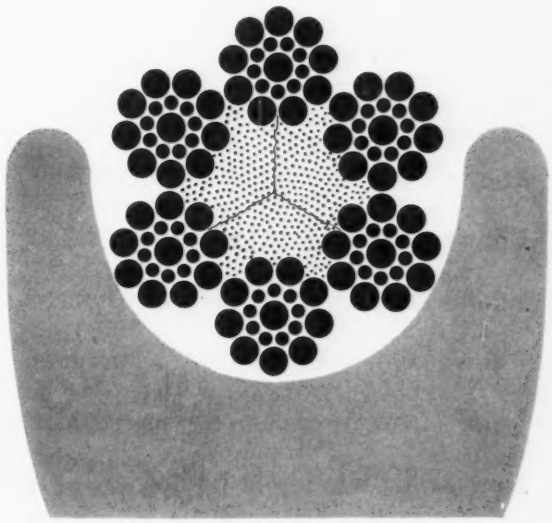

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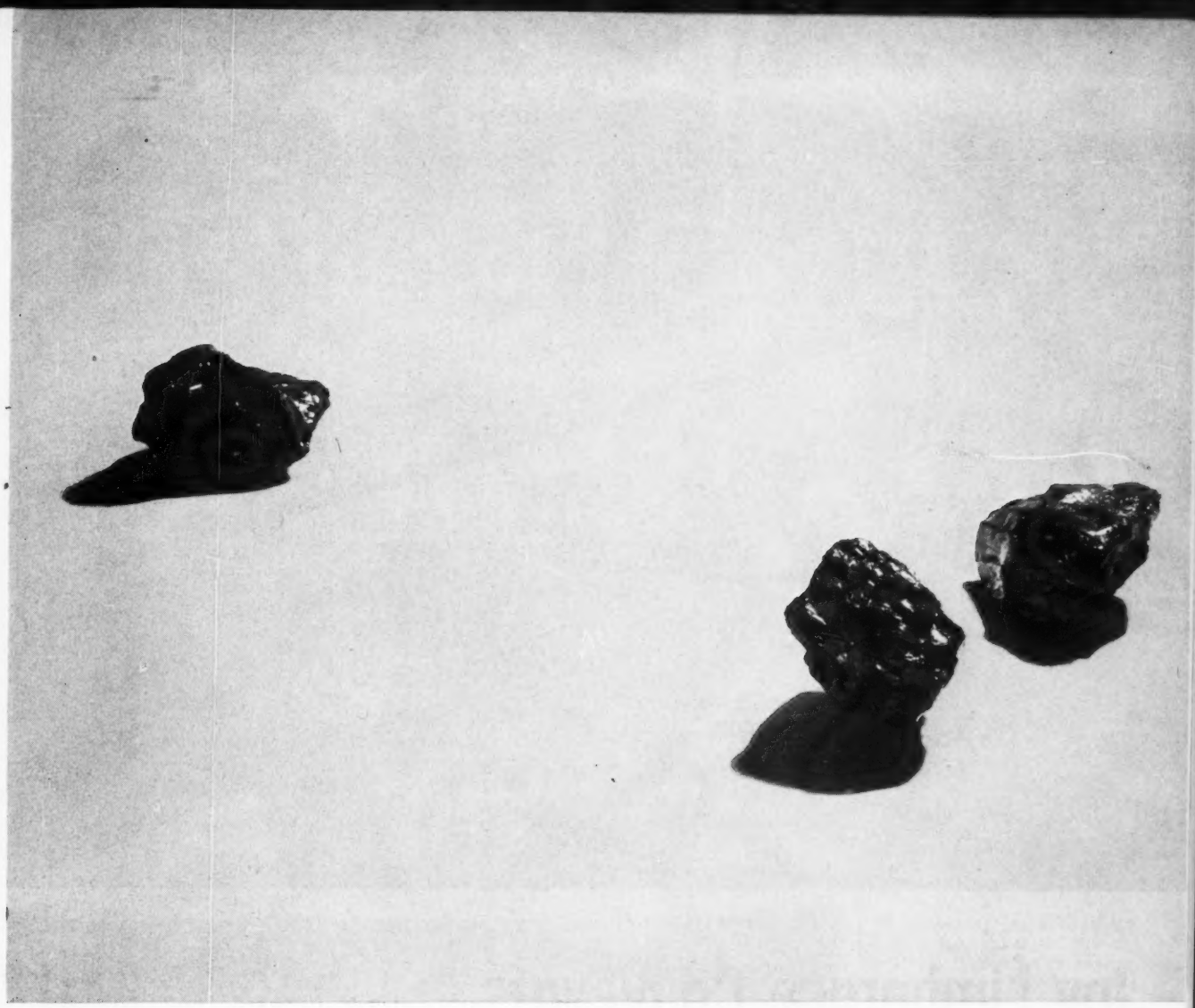

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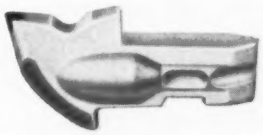

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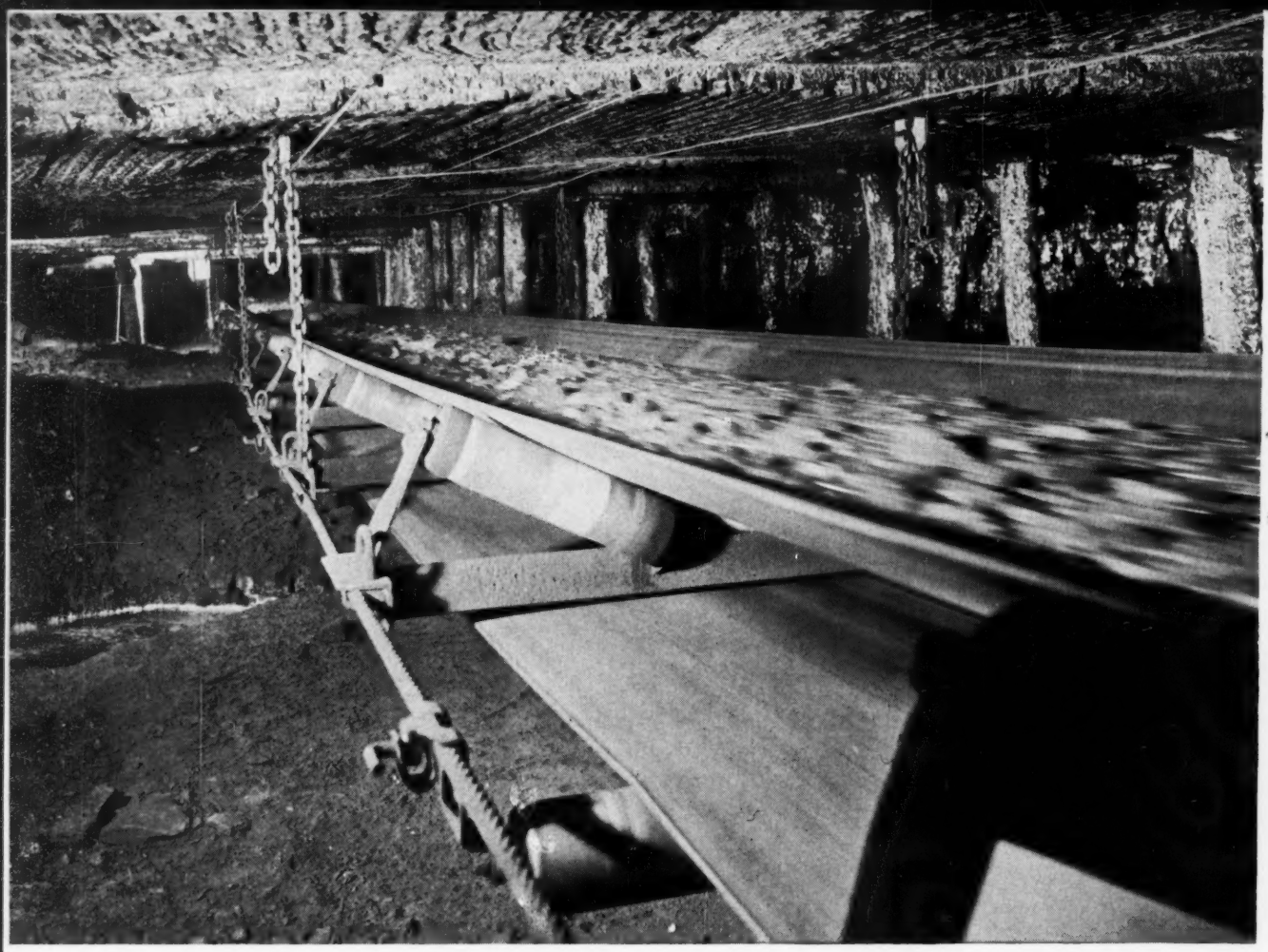

# Joy Limberope Conveyors Speed Haulage, Increase Tons per Man at Barnes & Tucker Lancashire No. 15 Mine

When an existing rail haulage system became too complex to operate economically, Barnes & Tucker Coal Company selected Joy rope-supported conveyors to replace sectional rail haulage. A 42″ Joy roof-suspended belt, 2820′ long, receives coal from 36″ butt belts serving two working sections and one advancing main. A 36″ Joy belt, 2800′ long, serves two additional 36″ butt belts. Since the installation of the Limberope conveyors, production has substantially increased.

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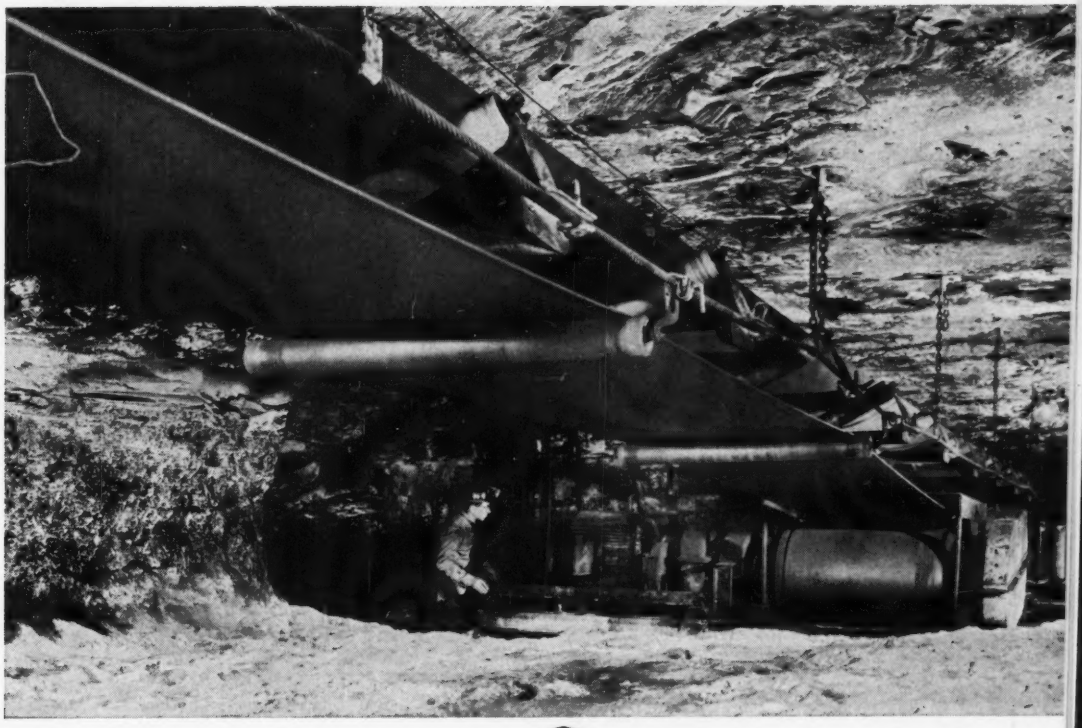
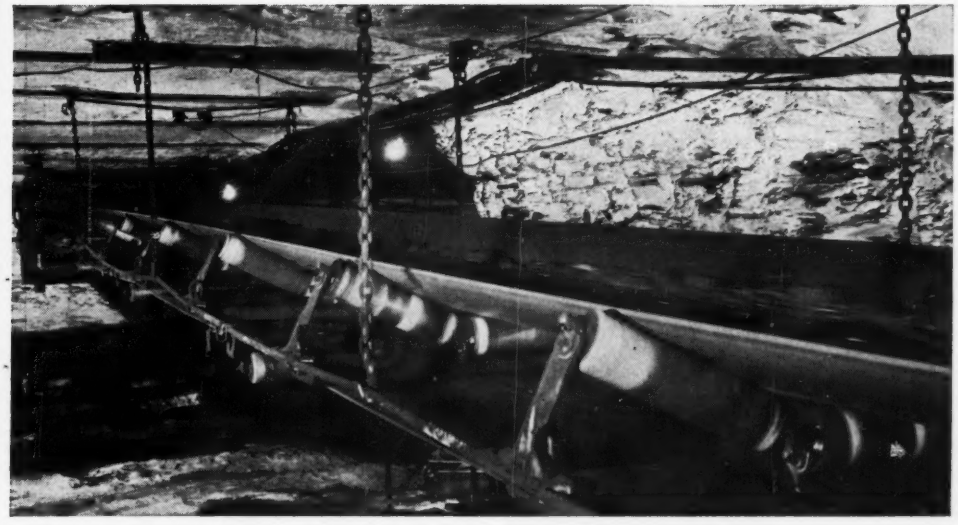
Joy offers complete conveyor systems for both underground and above ground applications, including drives, idlers, take-ups and pulleys. For complete information on the latest in Joy belt conveyors to suit your application, write for Bulletin 3860-1.



Drive unit with automatic hydraulic takeup is located 120 feet from the discharge end of belt. Notice ease of installation as belt is rope-supported from the roof directly over drive unit.



This close up shows excellent training and alignment possible with Joy Limberope conveyors. Chain suspension permits vertical adjustment in increments as small as ½ inch.

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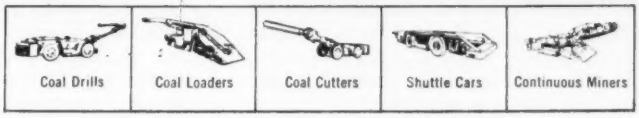


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**UNDERGROUND SAFETY**—Paul C. Lingo (left), BCOA; Paul Budzak, Freeman Coal Mining Corp.; T. K. Dale, Alabama By-Products Corp.; George R. Eadie, University of Illinois, and J. D. Reilly, session chairman and retiring general chairman of Coal Mining Section.

# NSC Explores Achievements

Coal Mining Section confers on safer mining methods, control of mine fires, improving ventilation and highlights in the development of fire-resistant hydraulic fluid.

DIFFICULTIES of mining thick seams, problems with "hot spots" in gob areas and developments in methane monitoring were among topics presented by speakers at the technical sessions of the Coal Mining Section of the National Safety Congress at Chicago, Oct. 16-18. Delegates to the meetings of the section elected officers for the coming year as follows:

**DESIGNS FOR SAFETY**—E. E. Quenon (left), Peabody Coal Co.; W. R. Cunningham, Pa. Department of Mines & Mineral Industries; Emery C. Olsen, Columbia-Geneva Steel Div., U. S. Steel Corp., and Joshua Smith, director of safety, Eastern Gas & Fuel Associates, session chairman.

Chairman—**Martin F. Brennan,** president, District 7, United Mine Workers of America, Hazleton, Pa.

First vice chairman—**Marling J. Ankeny,** director, U.S. Bureau of Mines, Washington, D.C.

Second vice chairman—**Nathaniel F. Kirk,** general superintendent, Snow Hill Coal Corp., Terre Haute, Ind.

Secretary-treasurer—**Harry F. Weaver,** chief, Branch of Coal Mine Inspection, U. S. Bureau of Mines, Washington, D. C.

Abstracts of the proceedings are as follows:

**Safety Aspects in the Modernization of a Coal Mine,** by T. K. Dale, safety director, Alabama By-Products Corp., Praco, Ala.

In designing and developing Segco No. 1 mine the aim was to make it the most efficient and safest mine possible. Safety was given primary consideration in selection of equipment and development of mining plans. Similar stress was laid on the selection and early training of employees. The selection process included physical examination with chest and back X-rays, and tests in mental ability and manual dexterity.

New employees are briefed by the safety department prior to their assignment to the operating department as trainees. In the operating department the new man is given on-the-job training until in the opinion of his supervisor he can safely handle an assigned job.

In physical features, the mine is equipped to provide 15,000 cfm of ven-

EQUIPMENT DEVELOPMENTS—Donald H. Zellers (left), U. S. Bureau of Mines; J. H. Minnick, Shell Oil Co.; Will B. Jamison, Safety Development Corp., and L. H. Johnson, USBM, session chairman.

# And Problems in Safety

tilating air at the last open crosscut, and each section is on a separate split. Permanent overcasts are constructed of steel and concrete, while temporary types are made of recoverable, prefabricated metal sections.

Water for dust allaying and fire-fighting is supplied from a 3½-million-gal reservoir. Pipelines extend along the mine entry with fireplugs at 250-ft intervals. A supply of fire hose is provided at each belt-conveyor drive.

Personal safety equipment is provided for all men in all sections, and first aid and mine rescue teams are prepared for emergencies.

Segco is an all-AC mine, except for a DC haulage system for transporting men and supplies. The latest in safety features, including a monitoring system for ground continuity in the underground network, have been built into the power distribution system.

Similar concern for safety is evident in the deisgn of the preparation plant, the supply-handling system and the coal-transportation equipment.

**Methods of Using Auxiliary Fans for Face Ventilation With Continuous Mining Systems,** by Paul C. Lingo, assistant safety director, Bituminous Coal Operators Association, Washington, D. C.

The Federal Mine Safety Code, effective July 24, 1946, resulted in the virtual elimination of auxiliary fans in underground workings because stringent conditions discouraged their use. With the passage of the Federal Mine Safety Act in 1953 the Code was revised in ways that led to the increasing use of auxiliary fans, but with safety conditions still closely guarded.

Several methods were developed for use of the fans under particular operating conditions and with particular types of machines. One plan, among the first to be adopted, uses a simple exhaust fan and tubing to increase the volume of air at the face. Another system employs a blower mounted on the continuous mining machine and an exhaust fan with tubing assisting the return.

Still another method, for full-face machines, features sheet-metal ducts leading air to the head of the machine from a fan mounted at the rear of the machine. Such experiments and applications stress several points, as follows:

Line brattice alone cannot provide the necessary ventilation at the face of a continuous-mining place.

Auxiliary fans and tubing, properly used, offer more positive, efficient and reliable ventilation.

Coal companies, signatory to the National Bituminous Coal Wage Agreement, must obtain a permit from the Joint Industry Safety Committee or USBM to conduct experiments with these fans.

These agencies have shown an alertness to hazards in misuse of the fans and an understanding of the operating problems involved in getting good ventilation at the faces of continuous-mining places.

**Control or Extinguishment of Gob Fires,** by Paul Budzak, safety director, Freeman Coal Mining Corp., West Frankfort, Ill.

Orient No. 3 mine, Waltonville, Ill., in the No. 6 seam, is the first mine in the state projected for complete pillaring. From its opening in 1951 until 1956 there were no incidents of gob-area heating. In the period from May, 1956, to October, 1961, there have been eight separate instances of heating in gob areas which are less than 2 yr old.

Indications of spontaneous heating are a haze in the returns, beads of condensed moisture on the roof near the gob, odor of heated bituminous material and a measurable content of carbon monoxide. Areas where spontaneous heating has occurred have been controlled by sealing with masonry stoppings and flooding with carbon dioxide. The areas varied in size from 20 to 800 acres, and the amount of carbon dioxide used varied from 18 to 300 tons.

In one instance, an attempt was made to discover the source of the heating by penetrating the gob with a loading machine. This was the only case in which flame was present, probably as a result of introducing oxygen during the penetration of the area.

Actual cause of the heating eludes observers at present. However, intensive study is underway to find the cause or causes as a preliminary step to redesigning recovery methods or bleeder systems.

**Hazards Encountered in Mining Thick, Inclined Coal Beds,** by Emery C. Olsen, supervisor—mine inspection, Columbia-Geneva Steel Div., U. S. Steel Corp., Dragerton, Utah.

A seam thickness of up to 16 ft would seem to afford an unparalleled opportunity to achieve high production, but this is not always true. Above a convenient working height the natural hazards and increased difficulty of the work combine to nullify the advantages that might be expected with high coal. High ribs and high faces present the constant hazard of sloughing.

Furthermore, the pitch of the seam (Upper Sunnyside) offers its own hazards. For example, the operation of shuttle cars at this inclination requires excellent maintenance of the cars, especially braking systems, and skill in handling them. Setting of the brakes to stop rotation of the wheels may not stop the car from sliding down the dip.

Faced with problems like these, Columbia-Geneva has developed methods which have contributed notably to an outstanding safety record. Columbia mine achieved a frequency of zero in 1960 to win the Sentinels of Safety trophy in the recent national safety competition for bituminous mines.

Special equipment has been a great help. The development of a bench mining system, in which 9 ft of top coal is taken advancing and the bottom coal is

taken retreating, has been of the greatest significance. This is borne out by a continuing downward trend in the number of injuries resulting from falls of roof, rib and face.

Steel cages to protect operators of continuous-mining machines have been used with encouraging success, and the use of cages is being extended to other machines. Machines have been otherwise modified for operation on the pitches, including the addition of cleats to crawlers. The degree of permissible wear on shuttle-car tires is limited to insure a good tread at all times.

**Pennsylvania's Dust Study Program,** by W. R. Cunningham, deputy secretary, Dept. of Mines & Mineral Industries, Harrisburg, Pa.

During the last biennium, ending June 1, 1961, the total occupational disease bill to the taxpayers of Pennsylvania was upwards of $27 million. Approximately 90% of this was paid to miners for lung disorders. Out of this comes the interest in dust control studies initiated by the Depts. of Health and Mines in Pennsylvania. Accordingly, dust laboratories have been set up in the anthracite and bituminous regions, and these have been staffed with state-certified men who have taken special training.

While the program is too new to provide any definite conclusions, it has been found that ventilation alone is not sufficient for allaying micron-size dust, nor will spray systems alone suffice. A healthy atmosphere at working faces depends upon both good ventilation and effective dust-allaying sprays.

The efficiency of some dust collectors for roof bolting is very high. It is this roof dust, containing from 35% to 65% free silica, that is most harmful.

**Safe Practices in Strip Mining,** by E. E. Quenon, safety director, Peabody Coal Co., St. Louis, Mo.

While many hazards exist in strip mines under normal mining conditions, some of these become much more serious under adverse weather conditions. Company records definitely indicate that severity and frequency rate increases are directly affected by adverse weather. Thawing after protracted cold spells usually results in undesirable working conditions on earthmoving jobs. These conditions appear to discourage workers and supervisors from following normal safety practices.

Highwalls and spoil banks become more dangerous after thawing or heavy rains. Handling power cables under such conditions is much more dangerous, and even walking becomes a chore.

It is also the consensus that extreme weather conditions cause more breakdowns. Temperature changes cause expansion or contraction of metals, lubrication is not so effective and working in mud and water overloads machines. The hazards multiply in repairing these breakdowns in inclement weather.

In the preparation plant safety depends to a great extent upon the design, construction, maintenance and operation of the facility. Fireproof construction, adequate lighting, ample clearance, guarded machinery, plant-washing systems, automated carloading, etc., are essential for maximum safety. The most hazardous period is believed to be while repairs are made to equipment following a breakdown. The men are in a hurry, and performing tasks that are not in their usual routine.

Some steps that can be taken to increase strip mine safety are (1) regulation of traffic to and from the pit, (2) use of safest possible explosives and handling methods, (3) development of coal-ripping techniques to eliminate explosives in breaking the seam. Erecting and dismantling heavy equipment can be highly dangerous; the job requires expert, experienced supervision.

**Experience in Fighting Mine Fires With Foam Fire-Fighting Apparatus,** by Will B. Jamison, Safety Development Corp., Greensburg, Pa.

The expansion ratio of foam is the ratio of the volume of foam to the volume of liquid within the foam. In high-expansion foam this ratio can be varied from a low of about 50 to 1 to a high of 1,500 to 1. When a foam having a ratio of 1,000 to 1 is driven onto a fire, the heat of the fire will flash the water in the foam into steam. The resulting mixture of air and steam will have an oxygen content of about 7.5%, or well below the level at which active burning of most flammable materials will cease.

With regard to an actual application of the foam technique to a mine fire, the recent incident at Montour No. 4 mine has been reported in detail in USBM Information Circular 8019. Certain details of this experience should be taken as lessons.

There was a long and unavoidable delay of about 10 hr between the discovery of the fire and the application of the foam. The importance of having equipment at hand in good condition—and of having the necessary materials—cannot be overemphasized. The delay was almost critical. However, since the foam was effective in controlling a deeply entrenched fire it can be assumed that earlier application would have been very effective.

In attacking the fire the foam generator was moved to strategic points surrounding the fire area and foam was introduced from these points. A full knowledge of air movements and air courses is essential for maximum fire-fighting efficiency.

The foam completely extinguished the fire in hundreds of feet of entry. In some places mine cars or fallen rock shielded the fire from the foam, but these spots were opened to direct action as a result of the foam.

"High expansion foam, water streams from fire hoses and other extinguishing means are purposely referred to as tools to emphasize that someone must use them. As with any tools, the skill and judgment of the men using them is the critical ingredient. With some notable exceptions, I feel that the greatest deficiency in the coal-mining industry is in training. Effective training programs will do more toward solving the fire protection problem of the coal-mining industry than any other approach. Other deficiencies are automatically exposed."

**Developments in the Use of Fire-Resistant Hydraulic Fluids for Underground Coal Mining Equipment,** by J. H. Minnick, staff engineer, Shell Oil Co., New York, N. Y.

In retrospect of 2 yr experience with fire-resistant fluids in the coal industry, it seems likely that future developments will involve modifications in machine hydraulic systems to provide improved fluid operating conditions. These will be accompanied by continued research and development in the area of improved fluids for this application.

With specific relation to coal mining, it is important to have available records of machinery history (individual machines), and prevailing operating conditions as a base line on which to judge appropriate modifications, if required. Accepted industrial hydraulic practice involves recommended suction conditions to pumps, sump tank capacity, operating temperatures and use of screening and filtration elements for maintenance of system and fluid cleanliness.

Introduction of the fluids has not been accomplished without various problems related to the differences in characteristics of these fluids. However, the inherent safety advantages provide the justification for continued effort to solve the problems.

Prices of the new fluids will generally be somewhat higher. Cost per ton of coal mined may be reduced, however, principally because of reduced consumption based upon improved hydraulic-system maintenance.

As in any project involving a new approach with certain unfamiliar material characteristics, a cooperative program among equipment builders, equipment operators and suppliers is required.

**Developments in Methane Monitoring,** by D. H. Zellers, chief, Research and Development Section, Branch of Electrical-Mechanical Testing, U. S. Bureau of Mines, Pittsburgh, Pa.

Abstract of Mr. Zeller's paper appears as a feature article beginning on p 91 in this issue of *Coal Age*.

**COAL RESEARCH**—George A. Lamb, director, Office of Coal Research, addresses delegates to 69th annual meeting of Illinois Mining Institute at Abraham Lincoln Hotel, Springfield, Ill.

## Equipment design, practical petrography, air pollution are themes at

# 69th Illinois Mining Institute

AN EQUIPMENT MANUFACTURER'S analysis of future needs, applications of coal petrography in marketing and operations and trends in air-pollution activity were major technical topics at the 69th annual meeting of the Illinois Mining Institute at Springfield, Ill., Oct. 20. The morning technical session was presided over by W. A. Weimer, chief engineer, Peabody Coal Co., St. Louis, Mo. Speakers were Robert D. Greer, mining sales engineer, Jeffrey Mfg. Co., Columbus, Ohio; John A. Harrison, coal petrologist, Illinois State Geological Survey, Urbana, Ill., and Louis C. McCabe, president, Resources Research, Inc., Washington, D. C.

Speaker at an afternoon session following the institute luncheon, was George A. Lamb, director, Office of Coal Research, Dept. of the Interior, Washington, D. C., on the subject of coal's potential and the activities of OCR. Eugene T. Moroni vice president—operations, Old Ben Coal Corp., was chairman.

At the business session which opened the proceedings, the 400 IMI members elected officers for the coming year as follows:

President—**Robert J. Hepburn,** vice president, United Electric Coal Cos., Chicago, Ill.

Vice President—**J. P. Weir,** vice president, Paul Weir Co., Chicago.

Secretary-Treasurer—**George M. Wilson,** Illinois State Geological Survey, Urbana.

Members elected to 3-yr terms on the executive board are **David Flota,** electrical engineer, Sahara Coal Corp., Harrisburg, Ill.; **Jack Simon,** Illinois Geological Survey, Urbana; **H. M. Tibbs,** assistant to president, Truax-Traer Coal Co., Chicago; **R. P. Wilson,** vice president, Bell & Zoller Coal Co., Benton, Ill.; and **W. C. McCulloch,** president, Roberts & Schaefer Co., Chicago, Ill.

### Future Equipment Needs

In the past customers received equipment that was sometimes merely assembled. In many instances the true design was done after the machine was built so that the next machine would perform to a limited extent, Mr. Greer pointed out, in explaining that the approach sometimes was "if it breaks, make it stronger." Present machine designers now study basic applications and needs of a machine before it is designed. That's why today's machine is vastly superior to its predecessors and why progress will continue.

Future machines must be designed on

**TECHNICAL ASPECTS**—Robert D. Greer (left), Jeffrey Mfg. Co.; W. A. Weimer, Peabody Coal Co., session chairman; John A. Harrison, Illinois State Geological Survey, and L. C. McCabe, Resources Research, Inc., Washington, D. C.

the basis of experience gained in past performance, Mr. Greer said, with the added note that breakdown-proof machines could be built if customers are willing to accept the price tag. Such reliability is evident every day in the airplanes that fly over our homes, Mr. Greer explained.

Challenges in future mechanization include the development of continuous, high-capacity transportation systems for mined coal, and closer study of operating conditions upon which to base a continuous vs conventional decision.

In the development of true remote control systems, the first step must necessarily be the use of "tethered area" concepts, in which the operator is near the machine yet removed from the area in which most accidents happen. Furthermore, all equipment must work together. There is no particular advantage in automating one unit.

One way in which the customer can be of great help in machine development is to keep accurate records of performance and maintenance on individual machines. These records can be the basis of future designs, Mr. Greer said. In any event, the manufacturer and operator must produce and use machines within the economic limits of their respective functions.

### Practical Petrography

One of the primary practical applications of coal petrography is in the calculation of coke stability based upon the relative proportions and types of reactive and inert constituents, Mr. Harrison explained. These proportions may be determined, especially in American practice, by the employment of transmitted-light techniques on thin sections of coal. Formulas have been developed to guide coke specialists in properly blending various coals to produce coke of desired characteristics.

In expanding on the possibilities in petrography, Mr. Harrison brought out that coal operators and bit manufacturers might find valuable avenues of investigation in studying the petrographic nature of coal with respect to design and application of coal-cutting devices.

Appended to Mr. Harrison's paper is a comprehensive list of literature on the subject of coal petrography.

### Air Pollution

Air pollution is a controversial subject, Mr. McCabe said, because every citizen considers himself an expert in one phase or another. Using Los Angeles County as primary background for his remarks, Mr. McCabe pointed out that smoke alone is not the only pollutant. The chemical industry is receiving considerable attention as a source of pollution. However, corrective measures in at least one instance provided a double benefit, as follows:

One refinery turned to the practice of scrubbing hydrogen sulfide out of refin-

ery gas for the primary purpose of reducing pollution. Utilization of the precipitated material resulted in a paying chemical plant.

Elimination of burning city refuse in favor of sanitary landfill disposal also was of great assistance in reducing Los Angeles air pollution, as was a ban on burning out scrapped automobiles within the area. This can be done just as well in specially-designed incinerators.

The big problem now in Los Angeles is the presence of 3,000,000 motor vehicles and the exhaust therefrom. The situation is aggravated by meteorological conditions peculiar to the area. The law now states that afterburners, when they become available, must be used, and new cars must be equipped with blowby devices to eliminate crankcase fumes. These stipulations may become a universal reality, Mr. McCabe said, in explaining that the annual investment in pollution-control research will soon amount to $30,000,000.

One of the newest trends is the installation of community monitors and alarms to detect and warn of increases in carbon monoxide, nitrogen oxides and other pollutants in the atmosphere. Successive alerts could be sounded, depending upon concentration of pollutant, with each alert followed by specific corrective actions, such as shutting down certain plants.

## Coal Research

A wide interest in the activities of the new Office of Coal Research is shown in the fact that over 150 proposals or suggestions for projects have been received, Mr. Lamb reported. Of these, 18 suggest coal-carbonization projects, five on liquid fuels from coal and 19 on market studies. Even presumably assured markets, like railroad fuel and retail deliveries, can be deeply invaded, Mr. Lamb reminded the IMI, in pointing out that coal's future markets are not assured. They must be developed.

Production at a level of approximately 410 million tons per yr during the past 3 yr is well below the 500 million tons per yr needed for a healthy coal industry.

OCR plans to concentrate in areas of applied research, but the need for basic research cannot be ignored. In its activities OCR sees no conflict with the research efforts of the Bureau of Mines.

Research goals of OCR are to (1) maximize coal in the American economy, (2) develop uses for refuse of coal production, (3) search for minerals in coal deposits and (4) investigate predrainage of methane from coal seams prior to mining.

Title to all resulting patents will be decided on an individual basis, Mr. Lamb said. Contract evaluation will be painstaking, and primary attention will be given to projects having some immediate prospects of gain.


FRIDAY MORNING SESSION—John Stratton, Gates Engineering Co.; Emil Luy, Bethlehem Mines Corp.; G. P. Mahood, Bethlehem Steel Corp.; Dave Bayer, Island Creek Coal Co., and J. W. Leonard, West Virginia University.

# White Sulphur Meeting

Central Appalachian Section, AIME, and West Virginia Coal Mining Institute discuss new trends and methods in mining, preparation and engineering.

RAPID METHODS for improvement, control and operation of coal dryers, selection and installation of high capacity face equipment, yieldable steel arches, aerial photography, rock dusting and haulage, plus a description of the N&W Ry's. new coal pier at Norfolk and a movie on mining engineers at work, were topics covered in three technical sessions at the 1961 annual meeting of the Central Appalachian Section, AIME, and the West Virginia Coal Mining Institute, Greenbrier Hotel, White Sulphur Springs, W. Va., Nov. 3-4.


FRIDAY AFTERNOON SESSION—John E. Caffery, U. S. Steel Corp.; William Diamond, Pittsburgh Pa.; W. J. Skewes, Pocahontas Fuel Co.; Arthur E. Belton, Mountaineer Coal Co., and John Rozance, Pittsburgh Coal Co.

Chairmen and co-chairmen of the various sessions were:

Emil Luy, Bethlehem Mines Corp., Johnstown, Pa.

John W. Stratton, Gates Engineering Co., Charleston, W. Va.

Stephen Canonica, Compass Coal Div., Clinchfield Coal Co. (luncheon).

John E. Caffery, U. S. Steel Corp., Gary, W. Va.

Arthur E. Belton, Mountaineer Coal Co., Fairmont, W. Va.

D. A. Zegeer, Bethlehem Mines Corp. (annual banquet).

Arthur Bradbury, Inland Steel Co., Wheelwright, Ky.

John Frassinelli, Semet-Solvay Div., Allied Chemical Corp.

Guest speakers at the luncheon and annual banquet were L. J. Timms, director, State of W. Va. Dept. of Mines, and Dr. Perry E. Gresham, president, Bethany College, Bethany, W. Va.

Technical sessions included papers as follows:

**Rapid Method for Improvement in Control and Operation of Coal Dryers,** J. W. Leonard, director of coal research, and E. J. Sandy, assistant professor of mining engineering, West Virginia University, Morgantown, W. Va. Paper presented by Mr. Leonard.

Continuous operational control of a thermal fine-coal drying process is an important requisite in maintaining high levels of productivity, efficiency and safety. The absence of a method for continuously monitoring the relative humidity and dew-point temperature of dryer off-gases results in dryer control being at best an art instead of a science. To compensate for the lack of continuous control, common practice is to use excess heat and/or air to prevent inprocess saturation which can lead to subsequent process flow blockages causing downtime. Thus, in an effort to reduce downtime by excess additions of heat and/or air, efficiency and safety in some instances are sacrificed. Efficiency losses result from wasted heat, while safety hazards may result from excessive temperature of operation. Therefore, an operational objective should be to supply a quantity of heat and air which will maintain dryer off-gases at 80% to 90% saturation. To reduce the hazards associated with thermal drying, the 80% to 90% level of saturation should be sought using the lowest practical heat level.

Although reliable continuous dew-point temperature measurement is not possible with conditions existing in dryers, the process dew-point temperature and absolute humidity can be calculated from information or data provided by existing

dryer instrumentation. However, the calculations are extensive and involved, requiring that the following variables be accounted for: (1) Feed rate, (2) feed moisture, (3) product moisture, (4) delivered fan volume, (5) atmospheric percent relative humidity, (6) atmospheric temperature, (7) combusion fuel feed rate, (8) percent hydrogen in combustion fuel, (9) barometric pressure and (10) process temperature.

The objectives of this paper are threefold: (1) to present the foregoing variables in a series of nomographs which permit the rapid determination of the process dew-point temperature and relative humidity, (2) to give examples of how to apply them and (3) to illustrate the basis on which the nomographs were developed.

The nomographs presented may be easily applied by operating personnel to improve process control and understanding. Much of this work was computer calculated and the resulting nomographs represent a considerable simplification of available methods in use for determining thermal dryer moisture balance.

**The Selection and Installation of High-Capacity Face Equipment,** David E. Bayer, director of development, Island Creek Coal Co., Holden, W. Va.

The basic reason for replacing the existing equipment in any given mine or economic interest is that the cost of production is not satisfactory to management and does not create the desired profits. The Guyan mine of Island Creek Coal Co. was such a case. Production had to be increased 125% to provide a profit to enable the company to perform its reason for existence, which is service to the community and to earn a dividend for its stockholders.

In 1959 Island Creek Coal Co. installed its first high-capacity conventional section. At present three mines are using conventional high-capacity equipment and five others are installing comparable face equipment.

The average work load of the entire sectional crew using the old equipment was approximately 65%.

The fastest cycle in the new sectional layout was now the roof bolting. It could bolt 35 cuts and it was decided to base the potential at 35 cuts. Past experience has shown that with a very efficient mine operation, an average of 60% of the potential of any equipment was the usual production obtained. If the most modern equipment available were installed an expected tonnage of around 800 tons per shift could be expected. This would be approximately a 100% increase in production per sectional shift, but to get the desired cost, a 25% further increase in sectional productivity would be necessary.

If a 25% increase in sectional production could be achieved, the mine would receive the following cost reduction benefits:

1. One less double-shift section—eight sectional shifts instead of 10.

2. A reduction of general inside labor as well as a 20% saving on sectional labor.

3. Haulage—fewer stations to serve.

4. General work concentrated.

5. Less capital investment.

Each item of section equipment was analyzed for any improvement that could achieve the goal set forth to get the desired margin of profit.

After equipment was installed, improvements made on equipment, establishing proper crews, standard operating procedures and training operators and foremen, the percent of gain of new equipment over old from January, 1960, to December, 1960, increased from 47% to 144%.

**SATURDAY MORNING SESSION**—Arthur Bradbury, Inland Steel Co.; John Frassinelli, Semet-Solvay Div., Allied Chemical Corp.; James B. Girod, U. S. Steel Corp.; L. A. Durham, Jr. Norfolk and Western Ry., and Carl Shelton, Virginia Polytechnic Institute.

**Yieldable Steel Arches in Coal Mines,** G. P. Mahood, Bethlehem Steel Co., Bethlehem, Pa.

Yieldable mine arches consist of arch or ring sets made of curved U-shaped rolled steel segments, heavily flanged to resist torsional stresses and designed for use under heavy pressures. They are tailor-made to suit an individual mine opening by being formed in huge presses. An arch set is built up of three or more segmental lengths nested at the over-lapped ends. Heavy U-bolt clamps are installed in pairs over the lapped joints and drawn tightly enough to hold fast under normal loads. As pressures or impacts bear down, the nested segments slide or yield, a little at a time before deformation occurs in the steel, thus maintaining structural integrity in the arch while permitting the ground to relax gradually.

In bituminous coal mines where pressures are mostly vertical a three-piece arch having two yieldable joints is normally used. In drifts or tunnels subjected to squeezing from all directions a four-piece ring set is recommended.

Yieldable arches have advanced beyond the experimental stage. They are the most economical means of roof support under adverse conditions. Main headings are being held open with yieldable sets where the strongest types of rigid supports would fail.

The yieldable arch is designed to "give" before it becomes excessively bent or distorted. Yielding must take place under heavy loads. The joint acts as a safety valve to keep the steel set from being destroyed. If the load on a set becomes too great the joint may slip only 1/16 to 1/8 in but the pressure will be greatly relieved. The resistance of an arch after sliding is augmented by the increase in over-lapping at the joints.

**The Mechanics and Application of Aerial Photography in Mapping,** William Diamond, Pittsburgh, Pa., and W. J. Skewes, Pocahontas Fuel Co., Pocahontas, Va.

The portrayal of the earth's surface is a true three-dimensional problem. Normal survey methods afford a two-dimensional answer. To control a three-dimensional problem with a two-dimensional device, it is necessary to obtain an infinite number of two-dimensional determinations. Aerial mapping provides an infinite number of possibilites and is the economic answer to the survey problem. This is expensive and as a result

much needed information concerning research, reserves and production is not accomplished.

Aerial mapping is simply a supplement to the normal field survey techniques and good practice in surveying must be the basis of all aerial mapping.

The mathematical principles involved in the determination of points of known value through the use of aerial photography is identical with the mathematics of surveying.

The accuracy of these determinations is directly proportional to the horizontal and vertical scale of the photograph. If the photography is 1,000 ft to the inch the horizontal determinations can be made to the accuracy of plus or minus 4 ft horizontally and plus or minus 2½ ft vertically. This means that the known elevations of the three points and the known co-ordinate positions of two points that are identifiable on the photograph can be expanded so that any point that is visible on this photograph which covers an area of approximately 2 sq mi can be examined and XYZ co-ordinates determined for the position in space of the point photographed.

To fully appreciate the importance of this ability to expand limited survey information into complete coverage of a three-dimensional surface, it must be realized that almost any number of horizontal and vertical determinations can be made in an area of 2 sq mi for a cost of approximately $200.

## Officer Rosters: 1961-62 West Virginia Coal Mining Institute

**President**—Joseph L. McQuade, Maust Coal & Coke Co.

**Vice Presidents**—N. T. Camicia, Island Creek Coal Co.; Harold Suter, Christopher Coal Co.; David C. Ridenour, Olga Coal Co.; Quin Morton, Kanawha Coal Operators Assn., and David Davis, Mountaineer Coal Co.

**Executive Board**—Roland C. Luther, Pocahontas Fuel Co.; C. R. Nailler, Christopher Coal Co.; George C. McCaa, Hanna Coal Co.; R. G. Lazzell, Island Creek Coal Co.; and S. Dunlap Brady, Jr.

**Secretary-Treasurer** — C. T. Holland, West Virginia University.

## Central Appalachian Section, AIME

**Chairman**—Fred R. Toothman, Chesapeake & Ohio Ry.

**Vice Chairmen** — R. C. Luther, Pocahontas Fuel Co.; J. L. Schroder, U. S. Steel Corp.; and Cleon Fowler, Pocahontas Fuel Co.

**Executive Committeemen** — E. M. Spokes, University of Kentucky, and Carl Shelton, Virginia Polytechnic Institute.

**Secretary-Treasurer**—C. T. Holland, West Virginia University.

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**Air Slide Rockdusting,** John L. Rozance, Pittsburgh Coal Co., Library, Pa.

The initial investment to equip a mine with facilities to handle bulk dust, first at the mine portal, then to the various sections of the mine and finally into the rockdust distributor, will be great. However, the savings obtained will warrant the expenditure.

Comparative figures on bantam dusting with bagged rock dust vs. Air Slide dusting are as follows:

| | Bantam | Airslide |
|---|---|---|
| Dust applied, tons | 8 | 34 |
| Hopper capacity, lb | 160 | 4,000 |
| Crew size | 3 | 2 |
| Total man-hours | 18.9 | 12.0 |
| Total dust applied per man-hour tons | 0.42 | 2.8 |

The cost of a bulk car capable of carrying 12 tons of rockedust is $6,900. The drive unit to aerate the bulk cars is $2,300. The 6-in screw-type conveyor is $1,800 and the Air Slide distributor is $6,600. The total cost of equipment to set up one section is $31,400. At present two sections are being rockdusted with one set of equipment.

There is a savings of $3.40 per ton in the cost of bulk vs. bagged rockdust. Manpower required to rockdust a section of the mine is cut in half. Normally, at a 5,500 tpd mine, 16 man shifts at time and one-half are spent weekly in rockdusting four advancing triple-shift sections, redusting areas after faces have advanced, and redusting haulage roads. With the use of bulk cars and Air Slide distributors, required manpower will be reduced to 8 to 10 man shifts weekly.

A net savings of $3.40 per ton on 5,400 tons of rockdust (used last year) amounts to approximately $18,000. Estimated savings in labor required is $14,500 yearly. Total savings add up to $32,500 annually.

**Haulage System—Maple Creek Mine,** R. C. Beerbower, Jr., general superintendent coal div., Frick District. Paper presented by James B. Girod, assistant general superintendent, U. S. Steel Corp., Uniontown, Pa.

In the selection of a transportation system all the factors of safety, economics and public relations were considered. Plans included haulage that could handle the coal produced, dispose of the refuse from the cleaning plant and supply the mine with necessary material. Because of the distance to the extremities of the property and the complex refuse and supply problems, the company resolved to use a high-speed, double-track haulage system.

Certain standards were adopted before a foot of track was laid. These standards, among others, are as follows:

Eighty-five-pound rail on 44-in gage are laid on standard 6 in x 8 in x 6½ ft treated ties placed on 24-in centers. Ties have a minimum of 6-in of slag ballast underneath.

The minimum clearance from top of rail to trolley wire is 65 in. The height is held at 72 in wherever possible. Maximum width for entry development is 14 ft.

Maintain a 3% maximum grade. Most grades are less than 1%.

Roof bolts are the primary roof and rib support. Only treated wood and steel are used in conjunction with bolting.

All permanent rail joints are welded electrically by a special process developed by Frick District maintenance personnel.

Trolley wire is 6/0 semi-catenary suspended with 500 mcm and 1,000 mcm feeder. Hangers are installed on 18-ft centers. Instead of trolley frogs, a parallel wire is installed at all 85-lb switches and extended 150 ft beyond the switch point.

Overpasses are constructed over all main traffic intersections.

All main switches are electrically operated with distance regulated automatic alignment that is activated by the pole of the motor.

All turnouts are engineered and use a No. 4 frog. Crossings between loaded and empty tracks are at 3,000 ft intervals and the switch is always laid with, not against, traffic.

A 54-ton single-unit type locomotive which develops 800 hp is used as the prime mover. Sanford-Day 9-ton drop-bottom mine cars with overlapping ends are used. They are a four-wheel car.

**Norfolk & Western's New High Capacity Coal Pier at Norfolk,** L. A. Durham Jr., Norfolk & Western Ry. Co., Roanoke, Va.

Norfolk & Western Ry's new proposed coal pier at Norfolk, Va. will cost $25 million and is expected to be completed by Dec. 31, 1962. The pier is being built to handle the expected increase in export coal and also to handle larger vessels in the 35,000-ton and 45,000-ton classes. Mr. Durham described the engineering and construction details and displayed a model of the pier.

**Men at Work—Mining Engineers,** Carl Shelton Jr., associate professor, mining engineering, Virginia Polytechnic Institute.

Mr. Shelton presented a movie made by the mining engineering department of Virginia Polytechnic Institute which shows the various duties and activities of a mining engineer. The movie is used to inform students entering the profession just what the life of a mining engineer is like.


**COMPENSATION COSTS, CONVENTIONAL MINING, MULTIPLE DRILLING AND SHOOTING, MINE FIRES AND EXPLOSION**—Stonie Barker, Island Creek Coal Co.; Arthur Bradbury, Inland Steel Co.; Jack Matheson, Island Creek Coal Co.; Fred Loving Jr., Kentucky Ridge Coal Co.; Herman E. Knight, West Kentucky Coal Co., and Everett Brown and Henry Hamblin, Kentucky Dept. of Mines and Minerals.

# KMI Holds 22nd Annual Meeting

Coal men from the coal-producing states of the country gather to hear talks on new mine developments, mining methods, safety, costs, and changes in coal supply and demand.

KENTUCKY MINING INSTITUTE, representing the nation's third largest coal producing state, held its 22nd annual meeting at the Phoenix Hotel, Lexington, Ky., Nov. 9-10. Attending were some 200 mine officials and manufacturer's representatives.

In the business session closing the meeting, members elected officers as follows:

**President**—Noah Mayhew, Blue Diamond Coal Co., Leatherwood, Ky.

**First Vice President**—Tom J. Little, Cranbrook, Ky.

**Second Vice President**—H. O. Zimmerman, Inland Steel Co., Wheelwright, Ky.

**Third Vice President**—Harold Kirkpatrick, Beech Creek Coal Co., Greenville, Ky.

**Secretary - Treasurer** — A. H. Mandt, Kentucky Department of Mines & Minerals, Lexington, Ky.

**Directors**—William Crawford, David, Ky.; H. B. Jones, Stone, Ky.; R. D. Jones, Dunlap, Ky.; C. H. Irwin, Benham, Ky.; B. W. Whitfield, Harland, Ky.; Norman Yarborough, Harland, Ky.; B. F. Reed, Drift, Ky.; Earl Forrest, Letherwood, Ky.; Clyde Franks, Wooton, Ky.; Harry LaViers Jr., Ravenna, Ky.; Edwin McGraw, Madisonville Ky.; James A. Miner, Madisonville, Ky.; Herman E. Knight, Madisonville, Ky.; and Aubin Higgins, Madisonville, Ky.

**Alternate Directors**—W. E. Wheeler, Big Sandy; John H. Gray, West Kentucky; S. A. Fox, Harlan; and W. T. Cahoon, Kentucky River.

R. L. Vines, Lexington, Ky., was program chairman. Clyde Franks, Mary Gail Coal Co., Wooton Ky., and George E. Evans Jr., Evans Elkhorn Coal Corp., Wayland, Ky. were co-chairmen, of the Thursday technical session. Co-chairmen of the Friday session were Herman E. Knight, West Kentucky Coal Co., Madisonville, Ky., and Fred Loving Jr., Kentucky Ridge Coal Co., Field, Ky.

**Coal Supply and Demand in the Nation's Expanding Market,** T. Reed Scollon, chief, Div. of Bituminous Coal, U. S. Bureau of Mines, Washington, D.C.

"Continuing emphasis on research, in view of our tremendously expanding energy requirements, could result in demands for coal that would make reality of the most optimistic projections of demand and could well surpass them."

On the basis of present knowledge, it seems reasonable to project coal demand in 1975 at 671 million tons. This assumes that no major technological breakthroughs will occur, that trends in production and consumption efficiency for each energy source will continue, current price spreads among fuels will remain the same, projected national economic developments of energy-consuming industries are used, present trends in foreign use patterns of fuels will continue, and there is no change in international policy or relationships. With these assumptions, the 1975 projected demands break down as follows (millions of net tons):

| | |
|---|---|
| Electric-power generation | 440 |
| Coke | 90 |
| Manufacturing and mining: | |
| Cement mills | 11 |
| Steel and rolling mills | 8 |
| Other mfg. and mining | 70 |
| Retail deliveries | 20 |
| Motive power | 2 |
| Exports | 30 |
| 1975 total | 671 |

Will coal be able to meet this demand? "If foreign supplies of energy should for any reason become completely unavailable to the U. S., our vast coal reserves, together with our indigenous energy sources, would assure us sufficient energy supplies to defend and advance our democratic freedoms and our standard of living. Indeed, our coal reserves alone, if necessary, could even provide us with oil and gas. The Nation's recoverable reserves of coal at only a 50% rate of recovery, could support current production for more than 2,000 yr."

**Handling of Bulk Rock Dust,** George Alston, Mine Safety Appliances Co., Pittsburgh, Pa.

The capital investment for bulk-handling rockdust equipment will not come cheap and in some mines will not warrant the investment. In most modern mines that have been studied to date, the savings gained by taking the manual labor out of the movement of rock dust, the lower cost of rock dust in bulk and the much higher discharge rates of rock dust with the fluidizing principle will warrant the capital investment.


**COAL SUPPLY AND DEMAND, ROCK DUSTING, MINE FIRES, ROOF CONTROL**—George E. Evans Jr., Evans Elkhorn Coal Corp.; Ward Padgett, Lone Star Steel Co.; George Alston, Mine Safety Appliances Co., and T. Reed Scollon, USBM.

It is felt that within the next year a number of mines will handle the majority of dust in bulk, thus bringing about more economic use of labor and, in turn, reducing the cost of maintaining an adequate coating of rock dust where it is required.

A bulk-handling system has been installed in the Pittsburgh seam of coal and the results so far indicate that a 75% drop in the cost of dust application, as well as a 33% drop in the cost of the dust in bulk against that in bags, can be expected.

The system consists of bringing the rock dust from the quarry in a semi-trailer tank truck. Approximately 12 min are required to transfer the 12 tons from the trailer to the bulk mine car. These cars are the eight-wheel type and are 7 ft wide, 52 in high and 21 ft long. They have a steel cover with hatches and are powered by a 5-hp motor.

The bulk mine cars are brought to the section and spotted on a spur track. A transfer conveyor 13 ft long and powered by a 2-hp motor is connected to the discharge port of the bulk supply car. Dust is then transferred at a rate of 1 tpm from the bulk car into an Airslide distributor. This distributor can be carried in a shuttle car or moved over the section by a rubber-tired mine tractor. The machine is 37 in wide, 12 ft long and has a minimum height of 16 in.

The hopper can be filled with 2,800 lb of dust in 1½ min. Dust is discharged at 600 lb per minute. The shuttle car can move at a rate of 100 fpm to obtain an application of 6 lb per lineal foot. Less than 5 min are required to completely dust 466 lineal feet of working area.

**New Concepts in Fighting Mine Fires,** George Alston, Mine Safety Appliances Co., Pittsburgh, Pa.

During recent tests at the USBM's experimental mine a new portable foam generator was designed that will conveniently fit into the category of secondary fire-fighting equipment in that it can be brought into play within minutes after the fire has started. This is the first time that high expansion foam can be directed into a dead-end entry.

The unit consists of an axial-vane fan mounted on a rubber-tired truck with a regulator on the fan intake to control the quality of the foam being produced and a honey-comb air straightener with fabric net on the exhaust end which produces the foam. Full cone spray nozzles play 10 gpm of water with 3% foam agent onto the screen to produce the foam. A minimum water line pressure of 20 psi is required. The fan is rated 5,000 cfm at 3.5 in w-g, and will deliver 5,000 gpm of foam through as much as 250 ft of 24-in tubing. The proportioner is set to deliver a minimum of 0.3 gpm of foam agent but can be adjusted to deliver up to 0.75 gpm of foam agent depending on the condition of the water being used. The operator can control the quality of the foam by observing it through the transparent tubing on the exhaust end of the fan and adjust either the regulator or the proportioning valve to compensate for unusual water conditions.

Some of the advantages of this system are that it can be operated by any man in the mine with reasonable success. It operates on normal mine water pressure and only a limited volume of water and foaming agent is required. Since the foam is transported through nonabsorbent tubing directly to the fire the full water content of the foam reaches the fire and is not drained off during transportation. The varying characteristics of water used in the mine for fire fighting purposes normally has some effect on the life of high expansion foam. Since the foam in this system is delivered directly to the fire within seconds after it has been generated, foam life becomes unimportant and the normal mine water will make satisfactory foam.

**Roof Control and General Mine Practices in England,** Ward Padgett, Lone Star Steel Co., McAlester, Okla.

"Great progress has been made in the past few years regarding roof control, longwall mining, ventilation and safety. The hydraulic roof supports are doing a good job with 3½ million in use controlling roof on the longwall system. At present only 6.4% of the mines continue to employ the room and pillar system, compared to 92.6% on the longwall system. Combined efforts and changing systems have reportedly reduced accidents 53% with no fatalities experienced where Dowty Roofmasters are used."

The average cost per ton mined in 1959 for all mines was $11.74. Daily wages are about $12.00 and payroll tons per manshift slightly over 3.

The natural conditions at the Bold operation are similar to the natural conditions at Carbon No. 5 mine at McAlester, Okla.

Mining was confined to the Grombouke seam which is about 53 in in thickness and on a pitch of 2 deg to 17 deg under 2,400 ft of overburden. Four longwall faces 600 ft in length using the Dowty Roofmasters for roof control are in operation. The British Jeffrey Diamond Anderton Shearer loader is used to mine and load the coal onto a conveyor that discharges onto a 30-in belt in the return airway, thus taking the coal to a point on the main haulageway where it was loaded into small mine cars with 1,200 to 1,400 lb capacity. These cars are of 24-in track gage using endless rope for motive power.

In the entries, the roof above the Grombouke coal seam is controlled by yielding arch supports on 36-in centers. Only two entries are advanced with the longwall, one on each end of the wall. One entry is used for intake airways and supplies and the other for return airway and belt line. The roof along the wall face is supported and controlled by self-advancing roof supports. British mines have 50 longwall sections using this system and are changing other walls to the same type as fast as possible.

**What Can Mine Supervisors Do to Reduce Compensation Costs?** Arthur Bradbury, assistant to manager coal properties, Inland Steel Co., Wheelwright, Ky.

Changes in the Kentucky Workmen's Compensation Act became effective June 16, 1960, and provided for increases in all rates, including the following maximums:

Temporary total disability from $32.00 per week to $36.00. Permanent total disability from $13,600 to $15,300. Permanent partial disability from $27 per week to $31.

Increases in death benefits: Maximum weekly payments from $30 per week to $34. Maximum total from $12,000 to $13,600. Burial allowance from $300 to $500.

Medical expenses of $2,500 can be increased an additional $1,000 by order of the board.

Insurance carriers were granted an 18% increase for large mines, bringing the charge from $6.88 to $8.12 per $100 of gross payroll and a 13% increase in connection with small mines bringing the present cost to $12.83 per $100.

It is more important than ever that, in addition to accident prevention efforts, mine supervisors help in controlling or reducing compensation costs by doing everything possible to keep their companies from being saddled with claims which have no occupational connection.

"I strongly suggest that supervisors conduct a complete and thorough investigation promptly of all accidents that are reported to them, no matter how trivial they may appear to be at the time. It has been my experience that an immediate investigation will reveal a more accurate picture of what actually happened than can be obtained after a delay occurs."

**The Future of Conventional Mining,** Jack N. Matheson, chief methods engineer, Island Creek Coal Co., Holden, W. Va.

Island Creek recently re-equipped two of its mines with conventional equipment, the installation being completed during the latter part of 1959. Crews were operating at an average tonnage level of 422 tons in 1959. With the installation of the new equipment this average shows a steady increase. The averages are the average tons of material per unit shift for the mine and not for the individual sections. Peak tonnages are as follows:

| | |
|---|---|
| Peak shift | 1,825 |
| Peak week | 1,406 |
| Peak month | 1,327 |

Considerations must be given to breakdowns. Any delay to the pick-up loader or continuous miner brings production to an immediate stop. Two operations are involved in producing coal on a continuous miner section. Any delay to either of these operations will result in a loss of production.

Comparing a continuous miner section with a section of conventional equipment, five operations are normally necessary to produce coal on a conventional equipment section. Generally speaking, with conventional equipment, either roof bolting, cutting, drilling or shooting will become a bottleneck to the maximum potential of the loading machine. Theoretically, when a delay is incurred by the loader, all of this time is not lost production. Since a bottleneck probably exists in the preparation cycle, a percentage of the shift will be lost waiting on coal to be prepared and if the loader is down, the preparation cycle continues.

"The future of conventional equipment is excellent and is probably expanding. This does not mean that continuous miners do not have a place in industry and that they will be replaced. Continuous miners do have a definite application and when manufacturers provide continuous haulage to complete the job, the use of miners will probably surge again."

**Multiple Drilling and Shooting with Airdox Equipment,** Stonie Barker, Island Creek Coal Co., Marieanna, W. Va.

"The multiple shooting installations which we presently have in operation give us many productive and financial advantages. By combining the drilling and shooting cycles into a single operation, we have reduced our face labor with no detrimental effect on productivity. In most instances, we have as a result of the effects of multiple shooting, increased our face production. With the reduction in fine sizes of our product, we have lessened the burden on our cleaning plants and also enjoy the increased realization gained with the larger sizes. We have in all cases reduced our shooting costs in going to the multiple air shooting system."

Prior to opening the Chilton mine at Coal Mountain, W. Va., a study was made to determine the mining method and equipment required that would produce the lowest cost product. These studies indicated that conventional type mining with loading machine would produce the required results.

Nine main headings, 24 ft wide on 60-ft centers with breakthroughs 20 ft wide on 80-ft centers are being driven by two sections. One section works five places and the other four. Face crew, exclusive of foreman and electrician, include a roof-bolting machine operator, timberman, cutting-machine operator, drilling and shooting machine operator, loading-machine operator, two shuttle-car operators and a utility man.

The TDF-24 mobile coal drilling machine incorporating the Airdox multiple shooting apparatus was installed in the Chilton mine. It carries all Airdox face equipment for multiple sequence shooting, including lightweight 600 cu in capacity Airdox tubes equipped with automatic discharge heads, two banks of sequence shooting valves (one of which is used as a spare), and necessary flexible rubber hose to connect tubes to sequence valves and sequence valves to the air supply at the last open breakthrough. The machine is also equipped with tubular steel racks for transporting the tubes.

The average distance traveled from the face of one heading or room to the adjacent heading or room is approximately 180 ft. This generally takes 2 min. Four holes, 3 in in diameter by 11 ft deep, are drilled. The holes are approximately 8 in from the top and angled back to where the hole barely touches the top. Drilling consumes about 4 min.

The operator removes the tubes from the machine and places them in the holes. The flexible hose from each tube to the bank of sequence valves remains connected at all times. This operation will consume about 1.5 min. The machine operator then takes the feeder or supply hose which is connected to the sequence valve bank and walks to the blowdown valve located in the last open breakthrough and connects this hose to the blowdown valve by means of a quick connect coupling. This consumes about 0.5 min. The total time involved in the shooting sequence averages around 1.5 min. The entire drilling shooting cycle is completed in approximately 12.5 min.

**Mine Fires and Explosions,** Everett Brown and Henry Hamblin, Kentucky Department of Mines & Minerals, Pikeville, Ky.

Since the last meeting of the Kentucky Mining Institute, five minor fires in active coal mines have occurred in Kentucky. No injuries resulted from any of the fires reported. However, three men lost their lives from exposure to afterdamp while exploring a mine which had been abandoned 8 yr previously.

The department has taken steps to prevent recurrences of accidents of this nature. State inspectors post warning cards at the entrances of all idle mines and all abandoned mines. A letter from the Commissioner is sent to the operators of abandoned mines advising them that no one is to enter the mine unless accompanied by a state inspector.

For inspectors to gain valuable experience in fighting mine fires the Kentucky Department of Mines has recently acquired an experimental mine in eastern Kentucky.

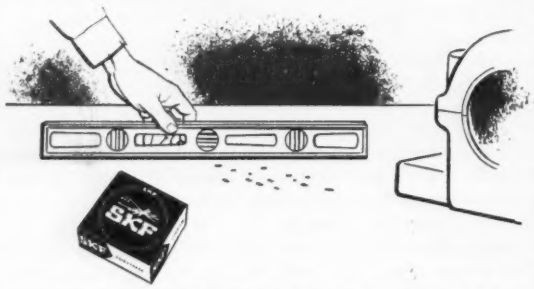
A new lightweight, unlimited - time, self-contained, chemical-oxygen breathing apparatus has been designed by A. H. Mandt, commissioner, Dept. of Mines.

The department has taken action to reduce the possibilities of fires and explosions in mines which use caps and fuse for blasting. It requires anyone who proposes to use caps and fuse to sign a statement that he will comply with the following provisions:

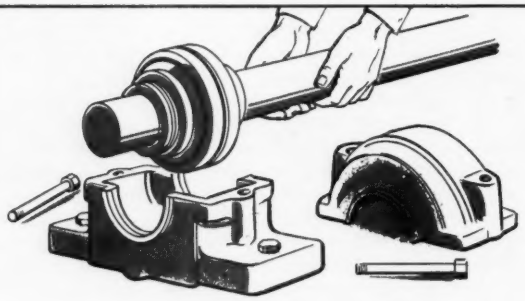
1. All blasting material must be handled and stored as prescribed by the mining law.
2. Fuse must be cut 1 ft longer than depth of hole.
3. Ample warning should be given before shots are fired and care must be taken to be sure that all persons are in the clear.
4. All shots must be fired immediately after charging.
5. Boreholes shall be stemmed with at least 24 in of incombustible material and at least two-thirds of the length of hole shall be stemmed. Do not use coal for stemming.
6. Before loading coal, replace timbers knocked out by blasting.

## DISTRIBUTOR DAN, the SKF bearing man, says:

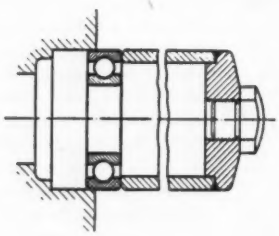
# "TEAR OUT THIS PAGE AND READ IT BEFORE YOU INSTALL A BEARING"



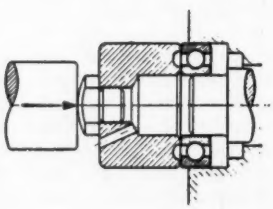

**CHECK THE HOUSING SUPPORT** first, for surface flatness and horizontal alignment. Then check the housing for correct position. Both checks are vital if you have to mount a non-self-aligning bearing in an independent housing.



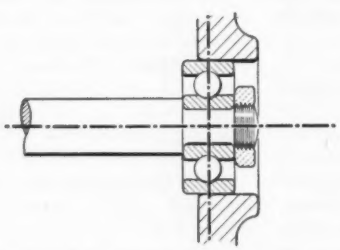
**WITH SPLIT HOUSINGS,** you simply lower shaft and bearing into the bottom half. Then secure the top half. Straight-through solid housings use bearings with rings that fit loosely with the housing, enabling you to push shaft and bearing into position.



**BEARINGS THAT FIT LOOSELY** on the shaft generally have a tight fit in the housing. In this case, mount the bearing in the housing by knocking on a mounting sleeve or by pressing. Then insert the shaft into the bearing.



**BEARINGS WITH TIGHT FITS** on the shaft and in the housing are usually mounted by fitting both rings simultaneously. Apply force to both rings but make sure it isn't carried to the rolling elements. Make sure the mounting sleeve and rings are flush.



**START IT SQUARE.** When you install a bearing in a solid housing, make sure the bearing is square with the shaft. If it enters obliquely, the more you try to seat the bearing the more trouble you'll have in moving it.

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# Foremen's Forum

## Aids to Section Discipline

Valid principles for motivation of people cut across all lines of human endeavor—work, play or study.

Here an educator offers food for thought on the matter of developing discipline in a working group.

YOU have no doubt heard the expressions, "The child is father to the man," or "Like father, like son." The message in these is that men can learn valuable lessons from children, especially as parents strive to provide the total needs and desires of children that will best help them to develop into useful adults; and that youngsters learn from the example of associated adults.

We are not saying that workmen are children, nor that supervisors are teachers, although there is some of both in all of us. We approach this subject because we recently read a piece by Eleanor M. Johnson, editor-in-chief, My Weekly Reader, a newspaper circulated among school children. We thought it made sense.

In addressing herself to teachers, Editor Johnson set forth some classroom aids to discipline. With some changes in emphasis her suggested aids may be transported into any situation where a group of people work toward a common goal under the guidance of a single leader.

Self-discipline is the result of guided practice and good example, Editor Johnson says, in pointing out that all teachers experience discipline problems at times, but that the persistent inability to control a class is one of the leading causes of teaching failure. Yet every classroom has innumerable opportunities to give pupils the guided example and good practice that foster good behavior. Nothing can substitute for the leadership of the teacher, but certain steps beyond this can be taken.

In the following, the boldfaced quotations are Eleanor Johnson's suggestions to teachers; the followups are Foremen's Forum's changes-in-emphasis addressed to mine supervisors.

**"Attractive surroundings—Children respond to the room that has pleasant surprises, interesting centers and beauty and harmony of line and color."**

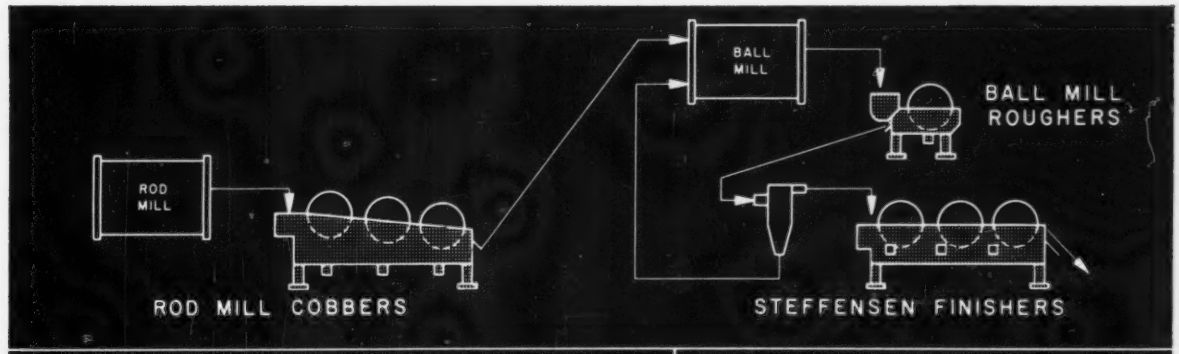
Your first reaction may be, how can a coal mine offer attractive surroundings? Well, some do just that. Since beauty is in the eye of the beholder, and since coal miners are able to rate the relative attractiveness of mining properties, it appears that good design at the outset and effective housekeeping later on distinguish the good-looking property from the not so good. These steps can be carried on underground, too. Effective rock-dusting, good cleanup, well-maintained transportation lines, good drainage and so on are impressive in a coal miner's eye, especially if he has worked under conditions at the opposite end of the scale of attractiveness. Improving the physical surroundings in which youngsters must study or men must work enhances that elusive quality of a well-knit group known as morale, a requisite of true discipline.

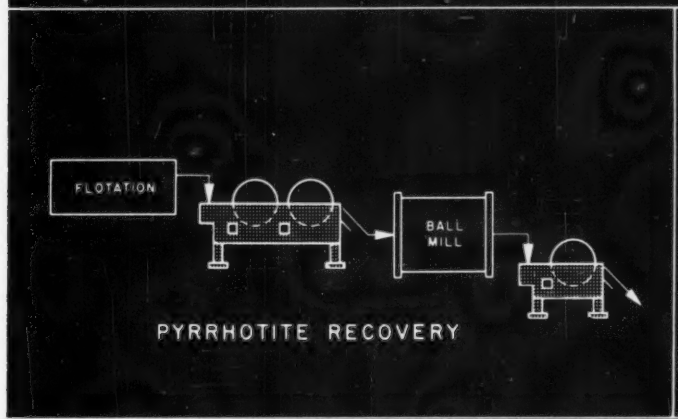
**"Order and system—A room that sets a good example of order and system has chalkboards that are cleaned after use, bulletin boards with a cared-for look, books and supplies returned to their proper places and a teacher and pupils who share the responsibility for leaving the room in order."**

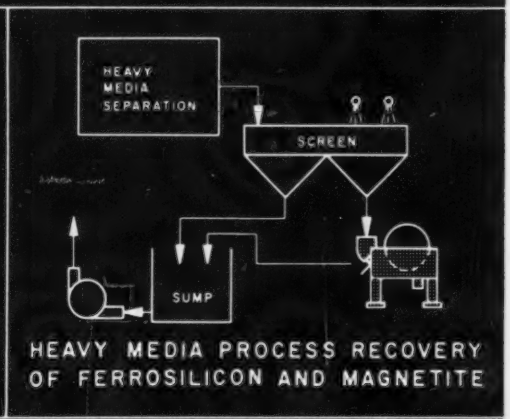
It has been said before on these pages that the root meaning of the word discipline is the Latin word meaning pupil or disciple. Discipline is the result of a teaching process; it is never developed through browbeating. Keeping tools and equipment in good repair and in their proper place are matters of habit. These habits can be developed in others through the example and urging of a good teacher—or a good supervisor. Consistency is the key, and consistency is a synonym for order and system.

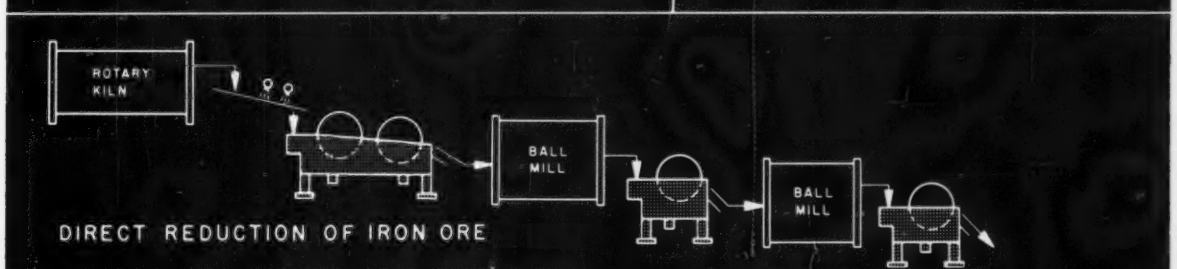
No better example of the value of order and system as an aid to discipline exists than that of roof bolting underground. The discipline is built in when a company safety rule calls for "roof bolts on 4-ft centers, both ways, with added support as required." The secret in mining is to develop engineered methods for doing jobs that will not require changes unless natural conditions or equipment change. The follow-through by good supervisors, making certain that the established order and system are pursued, nourishes the desired discipline.

**"A well-planned, interesting program—Work is discipline. Nothing does so much to promote self discipline as does an atmosphere of work or study. Children are in the classroom to learn. Most of them want to learn, but a dull and haphazardly planned program is bound to show up in pupil behavior. They will turn to mischief to relieve their boredom."**



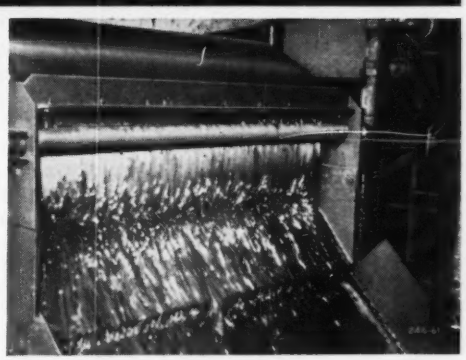


# See Jeffrey on your wet concentration and magnetic recovery problems

Jeffrey magnetic separators are exclusively of the drum type. This offers the advantage of extreme simplicity, since the drum is simply a water-tight cylinder of non-magnetic material. It is the only moving part.

*Electromagnets, Alnico* and the revolutionary new *Ceramic permanent magnets,* located within the drum and extending part way around the interior of the drum, are stationary and are supported on the shaft on which the drum rotates. The angular position of these magnets is adjustable to fit the needs of any particular problem.

Jeffrey engineers will assist you in selecting magnetic separators for your applications. Ask for Catalog 945. The Jeffrey Manufacturing Company, 912 North Fourth Street, Columbus 16, Ohio.



*One of twelve permanent magnet machines efficiently recovering magnetite in a large coal cleaning plant.*

*If it's conveyed, processed or mined, it's a job for Jeffrey.*

JEFFREY

A well-planned program includes goals. People like to work toward a tangible end. These goals need not be solely and exclusively based upon production. Improving a mine safety record is a goal. The ways and means of improving the record constitute the program. Needless to say, the record will not be improved if there is no program. Similarly, production goals, which really are a reflection of the competitive economics of the fuels industries, cannot be met if there is no program for doing so. The program includes the sequence of cuts that will be employed to recover a pillar, including all auxiliary operations. The best examples of preventive maintenance are based upon programs, thoughtfully prepared and diligently supervised. The great majority of people prefer to follow programs in group activities of any kind. People who won't or can't perform to a well-planned program are 'way out—definitely a minority, like Beatniks.

However, development of the program is the responsibility of management and supervisors as an aid to the directed achievement which we know results from discipline.

**"A sense of timing—Momentum is lost by waiting for dawdlers and latecomers. When it's time to begin—begin. Keep the program moving. Gage dismissal time so that children neither have to wait in line unduly nor to dash madly for the bus, pulling on coats and dropping gloves as they run."**

Timing is a highly-developed "sixth sense" in the highly-successful supervisor. He is not surprised by any turn of events. He is well-oriented in what has been done, what is being done and what is yet to be done as his program unfolds, and he is conscious of the time that should be consumed or where his timetable has been upset. If the timetable has been upset, he does not become upset. He compensates for this by realigning his crew or by adjusting the tasks yet to be done.

In any event, he makes a conscious effort to keep his program on schedule, assuming his advance planning has been well done. People do not like to wait in purposeless inactivity, so the good supervisor employs delay time to good ends. It is a tossup as to whether timing or planning is more important. We prefer to assign them equal weight.

**"Balance and variety—Tension is reduced and learning efficiency is increased by including in the schedule a time for activity and a time for rest; a time for noise and a time for quiet; a time for seriousness and a time for fun and laughter."**

If you're wondering how we will handle this one, so are we, for the moment. Let's change the emphasis, from rest, quiet and fun to pacing, relief and humor. (Humor has its place in all human relationships.) By pacing we mean that reasonable tempo of operations which is conducted by a composed foreman. He restrains himself from operating in a state of constant emergency because it is almost impossible to keep others keyed up to that pitch. The quality of workmanship suffers, and important jobs are done with a "lick and a promise."

By relief we mean the breaks in deadly routine that can be provided by an alert foreman as he stops a man for a moment to ask questions, to offer information or to conduct a short training session in job methods or safety. You see, there can be a number of reasons for any action taken by a foreman—one of the reasons can be to provide a moment of relief for a man performing an arduous task, as long as the time isn't wasted.

Humor, not horseplay, is permissible. Of course, the wise foreman is careful to avoid the earthy banter when one man is the target. We suppose the trick is to appreciate good humor and let the rest go by as though you did not hear it.

**"Mutual courtesy and respect—Children learn more about behavior from what adults do than from what they say. The teacher who treats his pupils with courtesy and respect demonstrates the kind of behavior he expects from them. Discipline problems do not thrive where teacher-pupil relationships are fair, firm and friendly."**

The Golden Rule applies in the mines, as elsewhere. If you appreciate recognition for a job that you have done well, then be ready to give similar voiced approval to your men when they've earned it. If you like to receive credit for your ideas, then be ready to extend credit to your men when their ideas solve problems.

If you expect them to pay serious attention to their jobs, you must take your own job seriously.

If you expect them to arrive at logical conclusions, then you must proceed on a basis of logic. Most friction among human beings is generated when men having a point of difference take an emotional approach to the problem. That's how grievances are born. The good supervisor tries to the best of his ability to eliminate emotions and personalities from his consideration of a problem. He is then left with logic alone as his only means of arriving at a solution—or a decision. The men will take their cue from this course of action, if it is consistently used.

**"Moral and spiritual values—Children need values to live by—moral and spiritual values, citizenship and character values. These values must be identified and made meaningful if they are to affect children's lives."**

This could come close to preaching if care is not exercised. Nevertheless, we state without apology that honesty, fairness, sincerity of purpose, a sense of service to community and an appreciation of what we have are basic to the well-being of America. We sometimes wonder when we read of the drift of things in the newspapers, but remember, it's the exceptions who make the news.

The point is that children spend more of their waking hours in school than anywhere else, and workmen spend more of theirs at work than anywhere else. Thus, school and work provide more opportunity for motivating people in a number of ways—for good or ill, growth or stultification, fulfillment or frustration. The direction they will take depends to a great extent upon the guided practice and good example provided by their leaders.

## The End of One—Beginning of Another

DESIGNERS of the calendar were men of brilliance to provide us with the turning point we have at the end of each year. The opportunity we have to look back in reflection and to look ahead in resolution should not be passed by. Have you achieved all your goals for 1961? How can you and I improve in 1962?

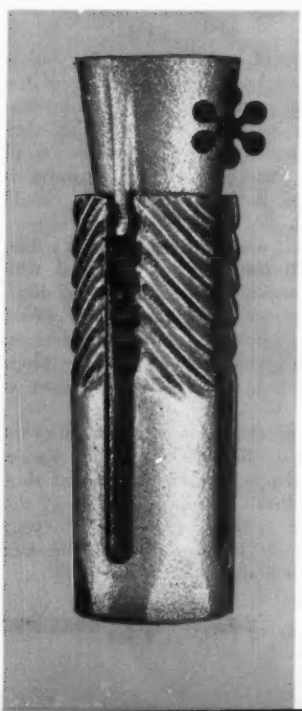
The month of January takes its name from the Roman god, Janus, who is pictured as a guardian of portals, having two faces to favor his seeing both inward and outward, where he was and where he's going, past and future. So the turn of the year should provide us with at least some time for reflection on these important matters.

We hope you prospered in 1961. Our fondest wish for you is that in 1962 your prosperity will be multiplied, that your usefulness will increase through your resolution and that happiness will abound among you and yours. We have appreciated your interest in what we do here, and we hope to continue to enjoy the pleasure of your company in the coming year.

In the meantime, have a very Merry Christmas. May it remind you that 2000 years ago we were given shining assurance that there is a firm basis for hope. And may the occasion remind all of us that we were not placed here to wander aimlessly, but to contribute to Man's splendid quest for fulfillment.

O-B Designs For Mining Men


# A 4-way expansion unit that holds in soft shale or hard rock



**4-WAY EXPANSION UNIT BUILDS HOLDING POWER FAST . . .** because the flexible fingers of the shell are slightly pre-expanded to grip the wall even before wrenching begins.

**GOES UP FAST AND STAYS PUT.** When the bolt is shoved up the hole, the expansion unit holds the bolt in place until it's tightened . . . no need to have hands exposed to injury during wrenching.

**GREATER STRENGTH IN HARD TOP . . . BETTER "PURCHASE" IN YIELDING TOP . . .** because the expansion pressures are spread evenly over the four shell fingers to make the best use of the entire unit's strength. These are the reasons for the O-B Expansion Unit's popularity with mining men. It is easy to understand why more mine roof is supported with O-B Shells and Plugs than with any other kind.

For further information and prices, see your local O-B sales-engineer or write us now. OHIO BRASS COMPANY, MANSFIELD, OHIO. Canadian Ohio Brass Company, Ltd., Niagara Falls, Ontario.

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EXPANSION SHELLS AND PLUGS • LINE MATERIALS • SAFETY AND CONTROL EQUIPMENT • ELECTRIC HAULAGE MATERIALS

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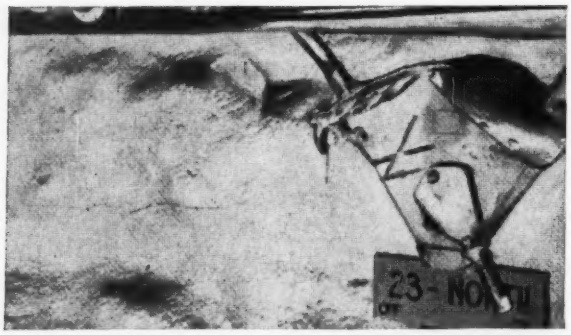
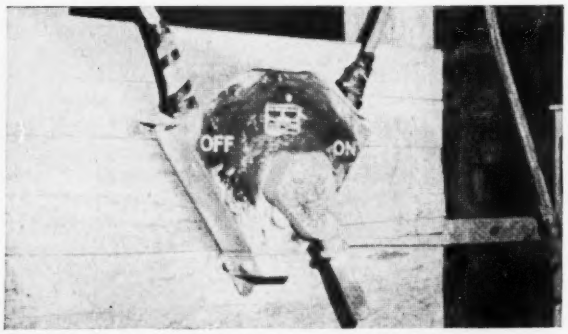
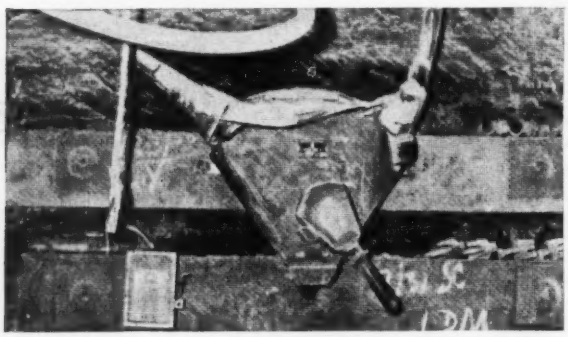
# Operating Ideas



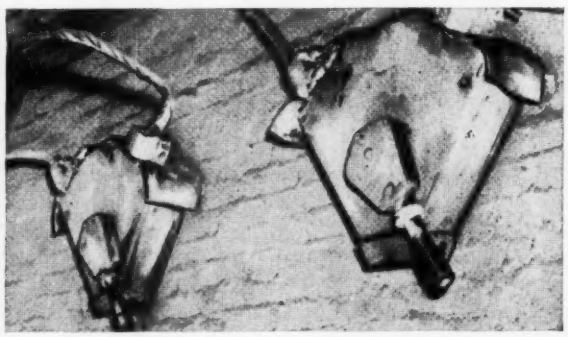
**OLD BELTING** makes an excellent dust cover for section insulator switch. Cover is held by hangers overhead system.




**STRIPS** of belting and friction tape provide protective easy-to-make boots for feeder where it enters switch case.



**ONE-PIECE** dust cover and boots is made by twisting belt around feeder and securing ends with tape.



**COVERS** are easiest to install when the switch is first mounted. Cable clamps hold these covers in place.

## A Safety Program For Switches

PLANNING can save you unnecessary expense in repairing or replacing electric switches and other equipment that are often disabled by dust. Rockdusting, for example, can cause damage to equipment designed to provide safe control of electric power in all underground areas.

The most important benefit of a sensible switch maintenance program is the assurance that safety switches will provide protection in event of an emergency. If a safety switch is damaged, dirty, jammed with dust or frozen from lack of lubrication, serious trouble may be ahead.

The following tips, which are adapted from *Haulageways*, published by the Ohio Brass Co., can help you make sure that your safety switches provide the insurance you expect from them. Here is a four-point program that is designed to save dollars and lives.

**1. Provide Dust Covers**—These can be made from scrap materials, such as, old conveyor belting, worn hose, flexible rubber or other insulating materials. Tailor covers to fit over switches where parts may be exposed to dust. Flexible covers for safety switches are best because they permit venting when high current is interrupted.

Smaller feeder or trolley switches benefit from dust covers. The extra safety and ease of operation that result are well worth the little time it takes to install dust covers on switches.

**2. Use Temporary Blankets** – Rockdusting crews can carry plastic sheeting on conveyor belting to cover switches, pumps or other devices that would be covered by rockdust. Temporary blankets will prevent direct infusion of dust which could result in expensive repairs as well as prevent the unit from functioning properly.

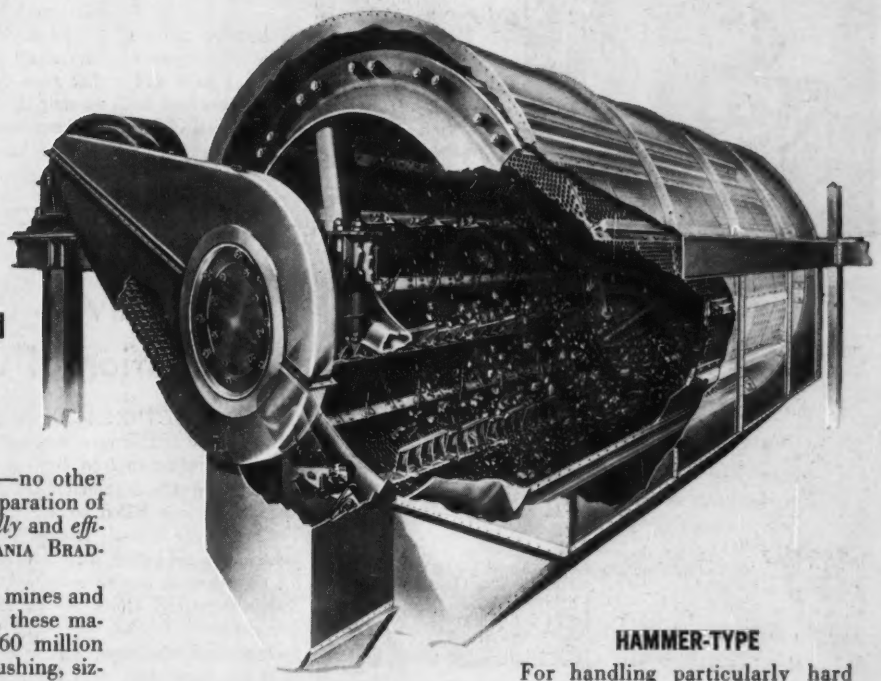
**3. Actuate Switches Regularly**—Operating them regularly is the easiest means of protecting safety switches against failures. This clears accumulated dust and oxidation from the contacts.

**4. Inspect and Lubricate Regularly**—Most switches will last the life of the mine but regular inspection and lubrication are necessary to insure that they will function properly. Lubrication of certain parts of electrical apparatus is beneficial but special materials should be used.

Bearing areas and pivot points within a switch can best be lubricated with an oil suspension of molybdenum disulfide. Contact blades of switches should be coated with a conductive lubricant, such as, Conducto-Lube. Vaseline, properly applied, will do the job almost as well.

It's important to use as little lubricant as will do the job adequately. Excess should be wiped off to prevent dust from collecting on it. Even though the lubricant is barely perceptable to your touch, the lubricant on the contact blades will do an excellent job.

# For maximum economy in preparation of ROM coal—it's PENNSYLVANIA BRADFORD BREAKERS



## Trunnion-mounted Roller-mounted Hammer-type

Mine-side or plant-side—no other crusher handles the preparation of ROM coal as *economically* and *efficiently* as a PENNSYLVANIA BRADFORD BREAKER.

At power plants, coal mines and by-product coke plants, these machines prepare over 160 million tons of coal a year—crushing, sizing and scavaging all in one continuous operation, at capacities up to 1500 TPH, and at average maintenance costs as low as $.001 per ton and power consumption averaging .204 KW per ton.

ROM coal is continuously charged at loading end. Passing sizes are immediately screened out. Larger lumps are raised by radial lifting shelves and dropped, breaking along natural cleavage planes to desired screen size, with minimum fines.

Refuse such as bony, sulphur balls, slate and rock, resist breakage, are automatically discharged at the refuse end along with tramp iron, timbers, etc.

### ROLLER-MOUNTED

Roller-mounted BRADFORD BREAKERS are particularly adapted for use at coal mines, as the spider at the loading end is designed to permit loading of extra large lumps of coal.

### TRUNNION-MOUNTED

Trunnion-mounting, where the revolving cylinder is suspended on trunnions, is the popular type for plant-side installations.

### HAMMER-TYPE

For handling particularly hard coals, or for heavier loading, the BRADFORD BREAKER is combined with a concentrically-mounted rotor of a hard-hitting PENNSYLVANIA HAMMERMILL at the rear end of the breaker.

Whatever the type most suitable for your need, if it's *economy* and *efficiency* you want—investigate PENNSYLVANIA BRADFORD BREAKERS. Write for catalogs, or call a Pennsylvania Engineer.

**PENNSYLVANIA CRUSHER DIVISION**
BATH IRON WORKS CORPORATION
WEST CHESTER, PENNA.

PENNSYLVANIA CRUSHERS
BATH-BUILT

## Chair Lift Carries Men in Pitching Seams

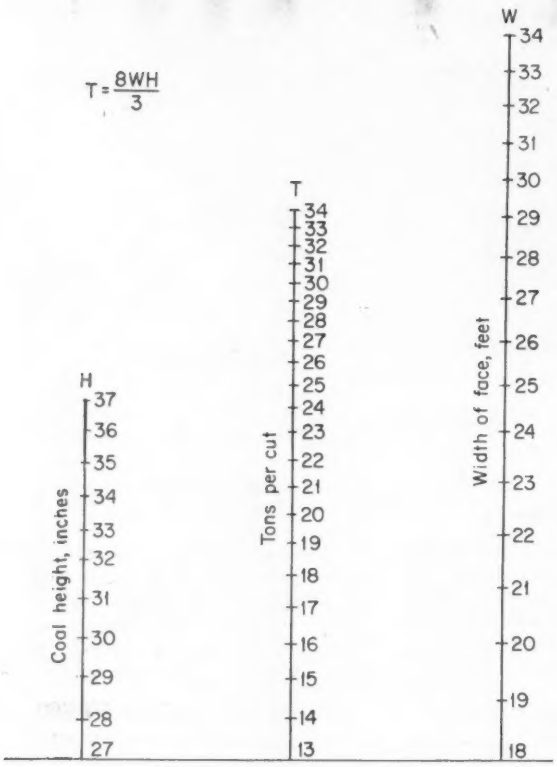
FASTER transportation of miners where other methods are impracticable is provided by a chair lift at several British mines, according to *Iron & Coal Trades Review*.

Dubbed the "ski lift" because of the steep gradients it climbs, the system negotiates grades of 1 in 2, 1 in 5 and 1 in 15. It travels from a terminal in the shaft, carrying men on special chairs attached to a ⅞-in wire rope by patent clips.

The motor-driven rope itself runs on pulleys attached to steel roadway arches. Although only five chairs are in use, the system is designed to carry men at 10-yd intervals at speeds up to 4 mph. A signal wire stretches along the full length of the rope.

The device not only can be used on very steep grades but also saves time in that men do not have to wait until a mantrip is filled before moving to the working area.

Since men are not concentrated in mantrip cars the system is safer. Riders' feet are never more than 18 in from the ground.




## Nomograph For Determining Tons Per 8-ft Cut

HERE'S a handy nomograph for quickly determining the tons of coal per 8-ft cut when coal thickness varies from 27 to 37 in and place width ranges from 18 to 34 ft. Developed by Clyde Storey, industrial engineer, Princess Coals, Inc., David, Ky., the nomograph is used by company engineers and operating officials to make fast tonnage calculations To use the nomograph, draw straight line from the coal-thickness line to the width-of-place line. Then read the tons per cut where this line intersects the tons-per-cut line.

## Paddle Device Reduces Degradation of Large Coal

A 3% REDUCTION in the degradation of large coal was achieved by installing a resilient paddle device at a transfer point, according to *Iron & Coal Trades Review*. Invented by O. Love of the National Coal Board's North-Western Div., the device is installed on a chute receiving coal from a belt.

The paddle is made from a length of 3-in mild-steel tubing which has mild-steel stub journals welded on each end. One of the journals has an extended shaft to which is attached a flat belt pulley. Holes are drilled through the tube on 3-in centers.

Pieces of wire rope, 2 ft 2 in long, pass through the shaft and are fitted with steel ferrules on either side of the shaft-tube ferrules. The ropes are then welded into position and the strands of the rope ends opened out to form a flattened brush.

Bearing brackets, fabricated from steel and fitted with brushes, are bolted to the side of the chute which has slotted holes to provide for adjustment of the paddle.

The paddle is driven through a crossed flat belt from a pulley of equal diameter fitted to the belt drive-pulley shaft. As coal falls from the belt toward the chute it hits one of the wire-rope paddles and is lowered to the chute bottom. The following paddle is then in position to repeat the operation.

## Equipment Starting Reminder

THE PRACTICE still persists of quickly starting heavy equipment by connecting it to an electric welder, reports the service department of International Harvester Co.'s Construction Equipment Div.

But most people forget that the current developed by the electric welders may be as high as 110 V and the starting voltage required by equipment is much less. One emergency boost with the welder may not cause any visible damage but serious trouble will develop with additional applications. For example, glow plugs have been known to melt because of the high voltage, and large numerous headlights, starting motors, generators, regulators and ammeters will have to be replaced if the welder is continued to be used as a starting aid.

By keeping the engine tuned and batteries charged, quick starting and less maintenance are possible.

*Here are five important questions . . . and their answers . . . on an important new Simplex development in electric power distribution and transmission*

# HIGH VOLTAGE POLYETHYLENE

## INSULATED POWER CABLES

Q. *What are some of the advantages of Simplex polyethylene-insulated high voltage cables?*

**A.** Low dielectric constant (nearly 1/2 that of paper cables) . . . Low power factor (nearly 1/10 that of paper cables) . . . Low dielectric loss (nearly 1/20 that of paper cables) . . . Very high insulation resistance (at least 10 times that of paper cables) . . . High dielectric strength . . . (equal to paper cables).

Q. *What are some of the outstanding physical properties of Simplex polyethylene?*

**A.** Light weight (62% of paper cables) . . . High tensile strength (1800-2000 p.s.i.) . . . High elongation (400% minimum).

Q. *Where can Simplex polyethylene cables be used?*

**A.** In many places where rubber or paper cable is used. Typical installations are direct burial, duct or conduit, aerial and submarine.

Q. *What is the highest voltage at which Simplex polyethylene cables are rated?*

**A.** Simplex now has polyethylene cable rated as high as 46KV A-C. Development work now in progress is expected to extend Simplex polyethylene's voltage range to 69KV or higher.

Q. *Has Simplex high voltage polyethylene cable been thoroughly field tested?*

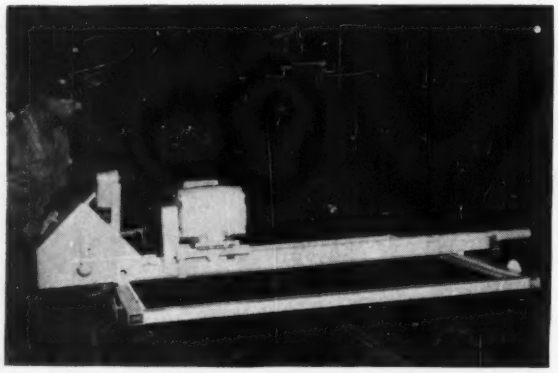
**A.** Yes, as the leading producer of polyethylene cables, Simplex has in service more than 330 mile-years of polyethylene-insulated cable in the 5KV to 46KV range.

*Send for complete information.*

**Simplex**
**WIRE & CABLE CO.**

EXECUTIVE OFFICES: Cambridge, Mass.
*Plants at Cambridge, Mass., Portsmouth, N. H., Westbury, L. I., Monrovia, Calif.*

# New Equipment News



## One-Man Coal-Cutting Machine

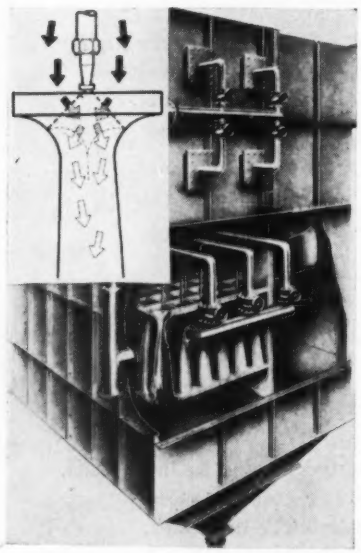
A single operator can transport and operate this revolutionary one-man coal-cutting machine called the "Mighty Miner." Described as a 150-lb square-frame drilling machine, it can be operated in seams as thin as 20 in. It costs approximately $1,095.

One man operates the machine with two handcranks—one to feed the auger bit into the face and one to move the auger assembly laterally along a rack-and-pinion positioning device. In this manner, a series of 13 holes is drilled in a straight line, making an undercut in the coal face.

A totally-enclosed, 110- or 220-V, 50-60 cycle, single-phase motor drives the tungsten-carbide auger tip. Wheelmounted and self-anchoring, the machine has an adjustable overall height of 18-24 in and an overall length of 82 in. Length of the frame is 60 in, width 42 in.

Optional accessories include power feed, power cross-travel and rail tramming device.

Mighty Miner Co., 1000 S. Fourth St., Connellsville, Pa.



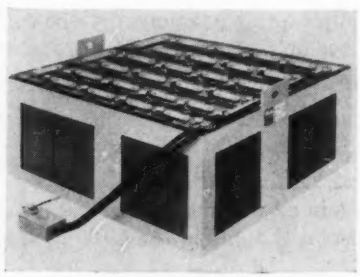
## Double Scrubbing

A new venturi scrubber for separating entrained solids from high-temperature gases offers advantages of low pressure drop and low water requirements. These, in turn, result in lower power requirements and lower operating costs.

The most unusual feature of this device is that it subjects the exhaust gases to a double scrubbing action as they pass through a bank of venturis (see diagram). At each venturi, a nozzle sprays a cone of water into the belled venturi entry and the gas receives its first scrubbing as it passes through this wall of spray. Its second scrubbing is received within the venturi as it passes through a second inverted cone formed as the water rebounds from the belled mouth into the throat of the venturi. This deflection of water decreases its velocity and breaks it into smaller droplets. While this takes place, the velocities of the gas and entrained solids are increased, due to the narrowing throat of the venturi. Thus, the faster moving gas stream passes through the slower moving water spray and is subjected to the second scrubbing.

The scrubber cleans gases of dust particles as small as 0.05 microns at efficiencies of 99% plus, reports the company.

Buell Engineering Co., Inc., 123 William St., New York, N. Y.



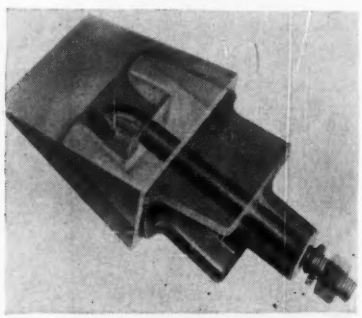
## Battery Capacity Boosted To Nearly 77%

Electrical capacities of nickel-iron alkaline storage batteries have recently been boosted up to nearly 77% in a significant design improvement.

Having been completely redesigned, new Type E Exide nickel-iron alkaline batteries now make much more efficient use of available space. They are capable of producing 100 amp-hr per positive plate and 1.202 whr per cu in, up from 0.68 whr in the former design. Still 22⅝ in high, the new models require no alterations in standard compartments of most trucks, including the critical height dimension. In addition, certain other design changes have permitted an increase in the number of positive tubes by 25% per plate, the length of the plates by one third.

Because these lifetime-guaranteed batteries have great mechanical strength, a noncorrosive electrolyte and can be stored indefinitely without deterioration, they can withstand abuse and use in extremely rugged service.

Exide Industrial Marketing Div., Electric Storage Battery Co., Rising Sun and Adams Aves., Philadelphia 20, Pa.



## Positive Fastening Device Featured on New Tips

Page "Tu-Par" tips feature a positive fastening device which is solidly an-

*PERCY:* "Here's our chance to lay away our winter's supply."

*ALBERT:* "No need to. Bethlehem keeps large stocks on hand all the time."

*PERCY:* "You mean we can get fast delivery on nuts and bolts . . . winter or summer?"

*ALBERT:* "That's right. Just call the nearest Bethlehem distributor or sales office."

Steel

*For Strength*
*... Economy*
*... Versatility*

# BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

*Export Sales: Bethlehem Steel Export Corporation*

BETHLEHEM STEEL

chored to the lip with one long hook bolt. This facilitates retightening, if and when necessary.

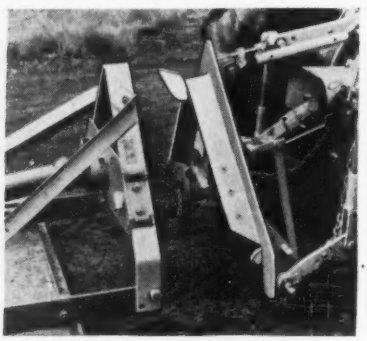
Tu-Par tip assemblies consist of the tip, holder and long hook bolt, made of special alloy steels, heat treated to the proper degree to insure maximum hardness and longer wear. Tapered for the best possible penetration, Tu-Par tips are self-sharpening, yet retain the toughness required to give maximum serviceability.

When the tip becomes worn, there is no need to replace an entire point since the holder will last the life of many tips. This feature results in a cost saving on an average of over 50% of that required to replace a solid one-piece point.

Changing is easy. Simply remove the hook bolts and the entire set can be changed in a matter of minutes, requiring only a slight raising of the bucket.

Completely interchangeable with conventional one-piece toothpoints, they are also reversible. Sizes to fit all Page Automatics are offered.

Page Engineering Co., Clearing Post Office, Chicago 38, Ill.

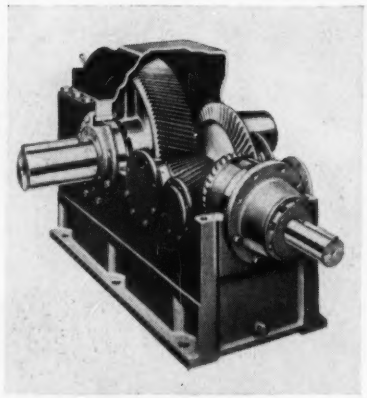


## Automatic Hitching Featured On Tractors

A simple and inexpensive device called the "Insta-Hitch" system offers tractor operators a means of coupling onto equipment in a matter of seconds without leaving the tractor seat. No second man is needed. The system is designed for rear-end three-point and tongued equipment as well as every type of attachment or tool used with the front-end loader arm.

Two triangular frames, one nesting inside the other, make up the design principle of Insta-Hitch. The outer frame (female) is attached to the various equipment to be used; the inner frame (male) is attached to the tractor. A guide hook is positioned at the apex of the triangle of the innner frame making the primary engagement for the two frame surfaces.

Powell Pressed Steel Co., Hubbard, Ohio, manufactures the new hitching system which has been approved by International Harvester Co. for its tractors.



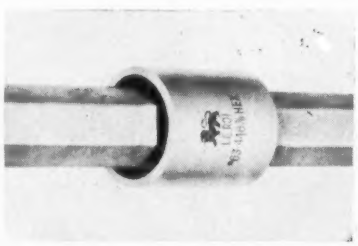
## Horizontal Speed Reducers

Two completely new series of horizontal speed reducers now available are the parallel-shaft Type Y with ratios 1.84 through 292 to 1, and right-angle Type YB (photo) with ratios 5.06 through 1207 to 1. Capacities range from 9,000 to 1,570,000 lb-in torque, in cataloged, standard units (higher in custom units) with 22 standard sizes for each type, permitting precise and economical selection.

Gears are single helical with precision-cut extra-depth high-pressure-angle tooth form for greater capacity and increased strength. The heavy-duty double-ended shafts can be turned 180 deg for double-gear life and have large diameters to accommodate maximum torque and overhung loads.

Other features include rugged housings with smooth flat surfaces for simple mounting of motor brackets, back-stops, etc. and oiltight, dust- and waterproof shaft seals which provide continuous positive lubrication. An automotive-type dip stick is used for easy oil check.

Falk Corp., P. O. Box 492, Milwaukee 1, Wis.



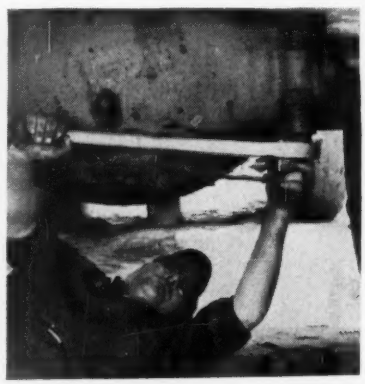
## Rubber-Lined Collar Reduces Drill Steel Cost

A new type of drill steel collar with a hard rubber sleeve can now be attached to ⅞- or 1-in steel to absorb shock and reduce breakage.

Replacing the forged collar currently used with precussion drills to hold drill steel in the chuck, the new rubber-lined collar reduces the initial cost of making up drill steel because expensive forging or heat treating is eliminated. Also, doing away with the heat-treat process allows the substitution of alloy steel for drill steel.

The collar itself is a steel sleeve 2 in long and 1½ in in diameter with rubber bonded to the inside diameter of the sleeve. To prepare the steel for attachment of the collar, first sandblast or clean with a solvent and wire brush. Next, apply an adhesive bonding agent to the finished steel surface. Then clamp the drill steel in a vise in line with an accessory air cylinder to position the collar accurately on the steel. The thrust from the cylinder sets the collar on steel.

Le Roi Div., Westinghouse Air Brake Co., Sidney, Ohio.



## New Tool Line Requires Less Effort

Made of an advanced heat-treated alloy of aluminum, the "Protolite" handtool line is reported to lessen muscle fatigue on long jobs and jobs requiring the operator to be in difficult, tiring positions.

Included in this high-strength lightweight tool line are two ratchet wrenches of a new design. It is claimed that weights are 43% less than steel wrenches yet equal in strength and exceed Federal torque performance specifications for steel ratchet wrenches.

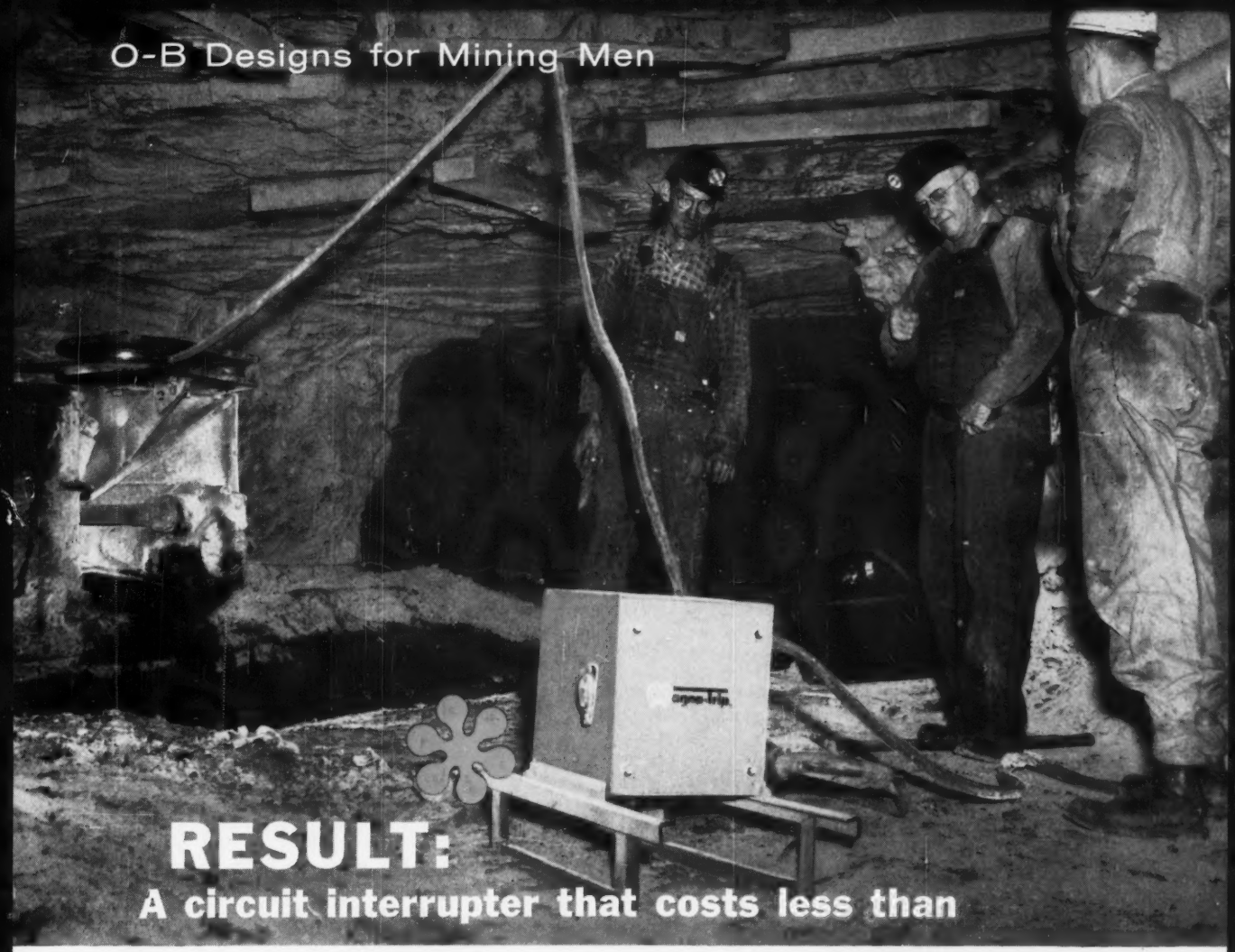
The company reports that the ¾-in square-drive ratchet is 19¾ in long, weighs just 3½ lb and is rated for 1,600 lb-ft. The new 1-in square-drive ratchet (photo) is 25½ in long, weighs 7¼ lb and turns 3,000 lb-ft.

Proto Tool Co., 2209 Santa Fe Ave., Los Angeles 54, Cal.

## New Scrubber Simply Designed

A wet scrubber of exceptionally simple design, combining diffuser, separator and tank, is reported to automatically

O-B Designs for Mining Men



# RESULT:

## A circuit interrupter that costs less than any other type of cable protection... except the fuse!

**MAGNA-TRIP SNUFFS OUT SHORTS BEFORE THEY HAVE A CHANCE TO CAUSE TROUBLE.** Ingenious design by O-B engineers results in a simple sturdy unit to protect machines, cables, and men. This safe control-device drastically reduces the danger and expense of cable fires.

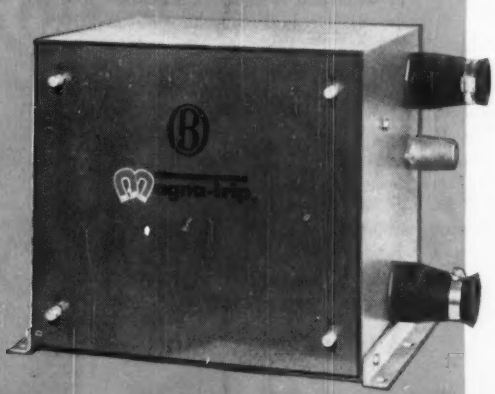
**VITAL MINING MACHINES PRODUCE MORE WHEN THEY'RE PROTECTED WITH MAGNA-TRIP.** This efficient unit reduces damage resulting from shorts and faults in cables. Less damage means less lost labor . . . less lost time . . . less lost production on your jobs.

**WHEN IT TRIPS . . . THERE'S TROUBLE.** Magna-trip has been designed to allow for normal surge loads without "false tripping." When Magna-trip kicks out . . . there's trouble on your circuit . . . and you've saved damage and delay!

**PAYS FOR ITSELF WITH THE FIRST CABLE IT SAVES . . . ALL OTHERS ARE PROFIT.** Magna-trips cost less than the ordinary length of cable that it protects. The **first** time that it saves a cable that would otherwise have been destroyed . . . you've paid for your circuit interrupter. In its lifetime, your Magna-trip will return to you its cost many times over.

**OHIO BRASS COMPANY, MANSFIELD, OHIO,** Canadian Ohio Brass Company Ltd., Niagara Falls, Ontario.

**Magna-trip keeps big machines moving . . . saves cables . . . protects equipment. Units are available in 100- and 300-ampere sizes for 250 or 600 volt circuits . . . All are compact, sturdy, reliable.**



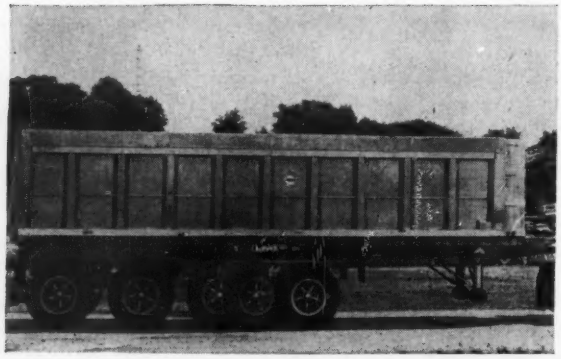

Ohio Brass

HOLAN

EXPANSION SHELLS AND PLUGS • LINE MATERIALS • SAFETY AND CONTROL EQUIPMENT • ELECTRIC HAULAGE MATERIALS

10052-M

## Trailer Permits Axle Loading Changes



A new type of sliding-axle dumping trailer has been developed to allow the operator to compensate for state-to-state legal load limitations in some circumstances. Adaptable to either tri-axle or tandem trailers, the Ravens sliding-axle principle permits the operator to move the front axle to any desired position within a 9 ft 2 in range, and then apply air pressure through an air-bag system to produce any desired axle loading at that point.

For example, a coal hauler might have a legal load of 47,250 lb in Ohio with a Ravens all-aluminum Tri-Axle trailer; however, as he approaches the Michigan border, the maximum legal load with fixed axles would be 39,000 lb. With the Ravens Sliding-Axle trailer, the operator moves the front axle forward 5 ft, applies extra air pressure, then legally carries the 47,250 lb into Michigan. The position of the sliding axle can be changed in either direction in less than 5 min.

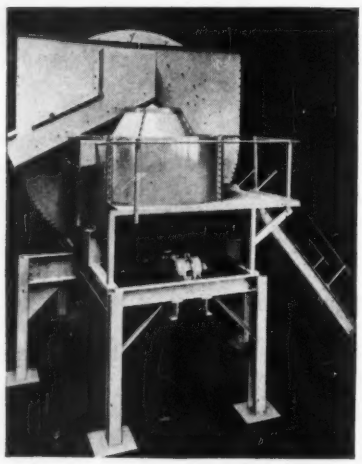
The extra payload provided by the sliding axle is 8,250 lb per trip, giving the operator some $800 extra income per mo.

Ravens-Metal Products, Inc., 1300 Market St., Parkersburg, W. Va.

maintain a dense bed of liquid in finely-divided state, by internal recirculation without pumps, nozzles or filters.

Operating at a pressure drop normally of from 3 to 6 in wg, the "Aeromix" is reported to recover soluble or insoluble particulate matter from air or gas streams in the processing of coal, rock products and the like. Standard capacities range from 1,500 to 33,200 cfm and larger units are to be made available.

For complete information, write Aerotec Industries, Inc., Industrial Div., Greenwich, Conn.



## Dense-Medium Separator

Primarily developed as a coal preparation machine, the Norwalt Separator embodies the high operating efficiency and capacity of a deep vessel in the height occupied by a shallow bath. The unit is constructed in the form of a cylinder with an inner cone over which a central boss is mounted on a shaft carried on bearings inside the inner cone away from the medium in the bath. During rotation, paddles attached by arms to the central boss sweep any sink material to the dicharge point. Sink material discharged from the bath can be removed by a drainage wheel, scraper, elevators, etc.

The design of the separator lends itself to modifications to suit specific requirements.

Nortons-Tividale Ltd., 307 N. Michigan Ave., Chicago 1, Ill.

## Rust Stopped By Galvanic Action

"Devcon Z," an effective new rust preventative, contains 95% pure zinc and 5% epoxy binders. Unlike other other "sealing paints" which retard corrosion by reducing moisture penetration, Devcon Z works on an entirely different principle.

Besides sealing out moisture, it also prevents corrosion by galvanic action. As an example, if Devcon Z is scratched through to the iron or steel, the zinc (anode) because of its position in the galvanic series will sacrifice itself to protect the base metal (cathode). This protection will continue as long as zinc is present. Also, it forms an insoluble zinc oxide layer on the scratched metal and thus protects against further corrosion.

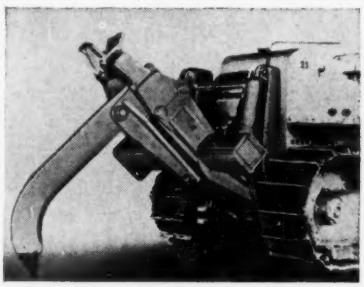
Simply applied by brush or spray, it dries to a gray metallic finish in about 30 min. The cost is approximately 1½ c per sq ft.

Devcon Corp., Danvers, Mass.

## Rugged Pipeline Ripper

When deep penetration is required, here is a ripper that will do the job. It is the Greenville "Pipeliner" especially designed for use on International's TD-25 tractor. It will rip to depths of 72 in.

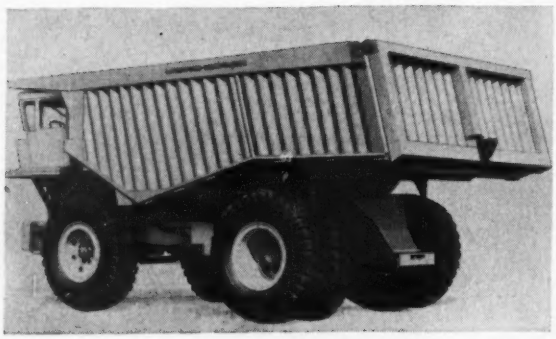
The ripper tool beam will accommodate one, two or three standard swing beam brackets when the special deep-throated pipeliner swing beam is removed. With these standard brackets installed, Greenville's 48-, 30- or 24-in penetration shanks can be used.



The shank smoothly swivels 15 deg in either direction on heavy pins—seeks out weak spots in rock. It gives points a live action that shatters rock with a jack-hammer action. All sizes of ripper shanks are equipped with replaceable points that can be changed quickly without special tools.

Greenville Steel Car Co., Greenville, Pa.

**CONTACTORS AND STARTERS**—New NEMA Size 5 contactors and starters—up to 65% smaller in open forms than previous designs—are now available completing General Electric's family of 100-line motor controls. In addition, the open forms are as much as 41% smaller in the critical height dimension. Open-starter dimensions are 14¼ in high, 11¾ in wide and 9 in deep. Enclosed forms are 31⅛ in high, 15¾ in wide and 10½ in deep. Features include smaller panel space requirements, easier wiring and faster inspection and maintenance. The size 5 is rated up to 200 hp, 600 V. Enclosed forms have a total of 10 combination knockouts—three at the top and bottom and two on each side. Tripfree overload relays on the starter are adjustable plus or minus 15% of nominal heater rating by merely turning a knob, company engineers report. General Electric Co., Schenectady 5, N. Y.



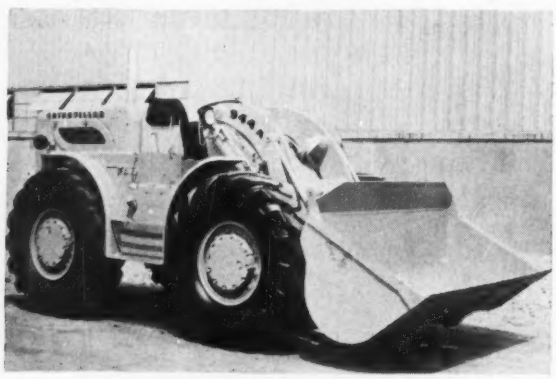
## New End-Dump Truck Carries 130,000-Lb Payload

The "Model 65 Haulpak" has been introduced as the world's largest-capacity single-rear-axle, end-dump truck.

A refinement of the Model 60, the new truck can accommodate either a coal or rock body. This interchangeability of bodies with considerably different yardage capacities and the same tonnage ratings is the most significant single change in the new model. Capacity of the coal body (photo) is 66 cu yd struck and 65 tons.

By using extra-high yield-strength steels and fabricated units in construction, the weight of the truck was trimmed to 69,850 lb empty, which is only 54% of its payload of 130,000 lb. A Cummins VT-12-700 turbocharged engine, with transmissions available to accommodate this horsepower, powers the Haulpak 65. It was built to be more rugged and less complicated and troublesome than conventional trucks built with "Automotive-type" assemblies which were entirely eliminated or replaced by tougher "earthmover-type" components.

For complete information write to LeTourneau-Westinghouse Co., 2301 NE Adams St., Peoria, Ill.



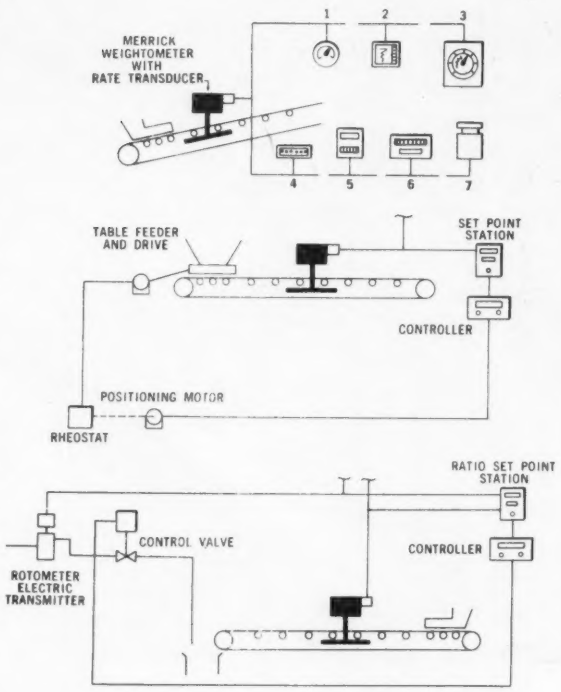
## New Buckets for Loaders

Nine new general application buckets (three types for each of three models) featuring new extended cutting edges are now offered for Cat wheel-type loaders.

Induction hardened, the edges are self-sharpening to retain good penetration throughout their service life. Cast-steel corner pieces are welded both to the cutting edge and to the bucket. These hardened corner pieces provide maximum strength to withstand heavy stresses which are concentrated on the corner of a bucket at work. Holes for mounting bucket-teeth adapters are predrilled in buckets of the types normally used for excavation work.

The new units join six previously available (two types for each model), raising to 15 the number of buckets now offered for the 966, 944 and 922 loaders. The two previous models are the standard type which offers the broadest application potential of the five designs and the Light Material type designed to handle light, easily-loaded material. The three new types include reduced-capacity buckets of standard widths designed for loading heavier-than-average material, narrow-width models and standard-width, increased-capacity buckets for work in lighter materials but in applications calling for a standard width bucket.

Caterpillar Tractor Co., Peoria, Ill.




## Device Converts Moving Weight To Electrical Signal

A rate transducer which translates measurement of moving weight on a conveyor belt into an electrical output signal is now available.

The signal, in direct proportion to rate and speed of the moving weight, can be fed into a computer system to control other processes, or to control its own conveyor through a closed-loop system. Tagged the "Integrator Rate Transducer Type WT-1," it consists of a pulser wheel, proximity pick-up coil, integrator rate transducer, range box and a measuring instrument such as a meter, recorder, controller, etc. This device can be installed on any Merrick Weightometer since basically it converts the mechanical rotation of the Weightometer integrators into an electrical pulse or frequency output. It accomplishes this with a pulser wheel and proximity coil pick-up.

The pulsing electrical output is converted to a DC or straight-line voltage output through a solid-state amplifier integrating circuit. This output is then filtered and adapted to whatever readout instrument is required.

Three typical applications are: With readout instruments (upper), as part of a feed-control system (center) and in a solid and fluid-flow-ratio blending system (lower).

Merrick Scale Mfg. Co., 180 Autumn St., Passaic, N.J.


# THESE CABLES ARE PRICED THE SAME ...BUT ONE CAN SAVE YOU MONEY!

The special high visibility color jacket you see on the Phelps Dodge TUFPLY portable cable is not just decoration. It has a practical dollars-and-cents value. Developed for use in Phelps Dodge open pit mines, this brightly colored jacket has established records for lengthening cable life.

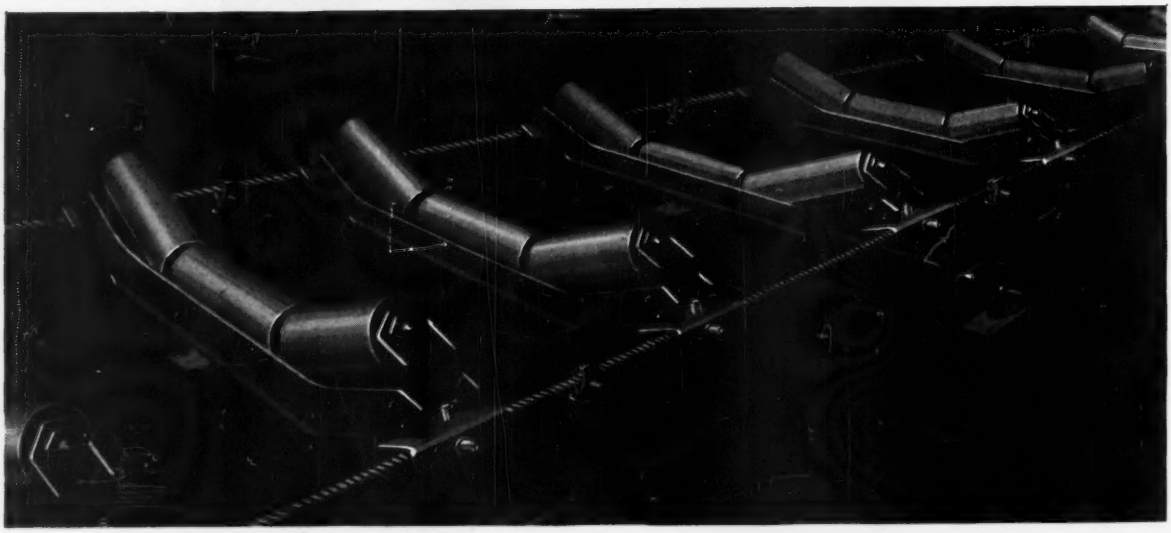
How? By making the cable clearly visible to operators of trucks and other equipment, needless on-the-job damage is avoided and cable life is extended. If cable damage by careless operators is your problem, call your Phelps Dodge representative today.

PHELPS DODGE COPPER PRODUCTS
CORPORATION • 300 PARK AVENUE, NEW YORK 22, N. Y.

THE "STAND OUT" JACKET MAKES CABLE "STAND UP" LONGER!

# LOW COST

## H-R WIRE ROPE CONVEYORS



### *Standardized components for complete conveyor shipped quickly*

You get tailor-made efficiency with minimum engineering at off-the-shelf prices with H-R wire rope conveyors. Modular design head and tail ends are compact, simply constructed. Erection time is decreased 66% and load carrying capacity is increased 13%, as compared with other conveyors.

See an H-R wire rope conveyor in operation . . . above or below ground. Contact your H-R field engineer or write Hewitt-Robins, Stamford, Connecticut to arrange an inspection tour.

**SECRET OF H-R LOW COST:**

Compactness, light weight, easy to handle, elimination of bulky structure, minimum storage required, reduced inventory investment.

*Basic data on wire rope conveyors . . . Write for catalog 12-49.*

**HEWITT-ROBINS**

Conveyor Machinery and Belting • Power Transmission
Hose • Processing Equipment • Engineering Services

Machine pictured is a Jeffrey COLMOL

# A breakdown here could cost 1.25 tons per minute

**A Texaco "Stop Loss" Program can keep it from happening in your mine.**

A Texaco "Stop Loss" Program can lengthen equipment life by uncovering lubrication problem areas and recommending solutions—*before* the equipment breaks down. The program will also raise tons-per-man rates by extending intervals between overhauls. It may even help you slash over-all maintenance costs by as much as 10 per cent.

**How Texaco's Program works:** Texaco's "Stop Loss" Program is primarily concerned with getting the right lubricants into the right place at the right time. It involves a study of your requirements, an analysis of your special problems . . . finally, the selection of the proper lubricants and the training of your personnel in their application. *And it produces results.*

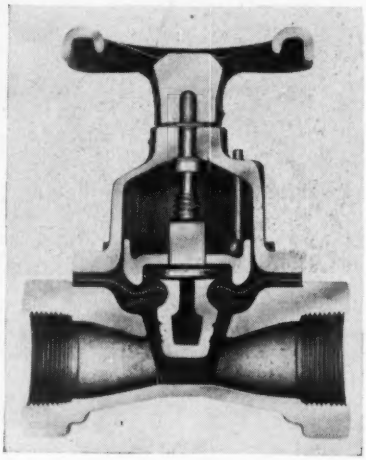
Ask your local Texaco Representative to prove what a "Stop Loss" Program can do for you. Texaco Inc., 135 East 42nd Street, New York 17, N. Y.

Tune in: Huntley-Brinkley Report,
Monday through Friday—NBC-TV

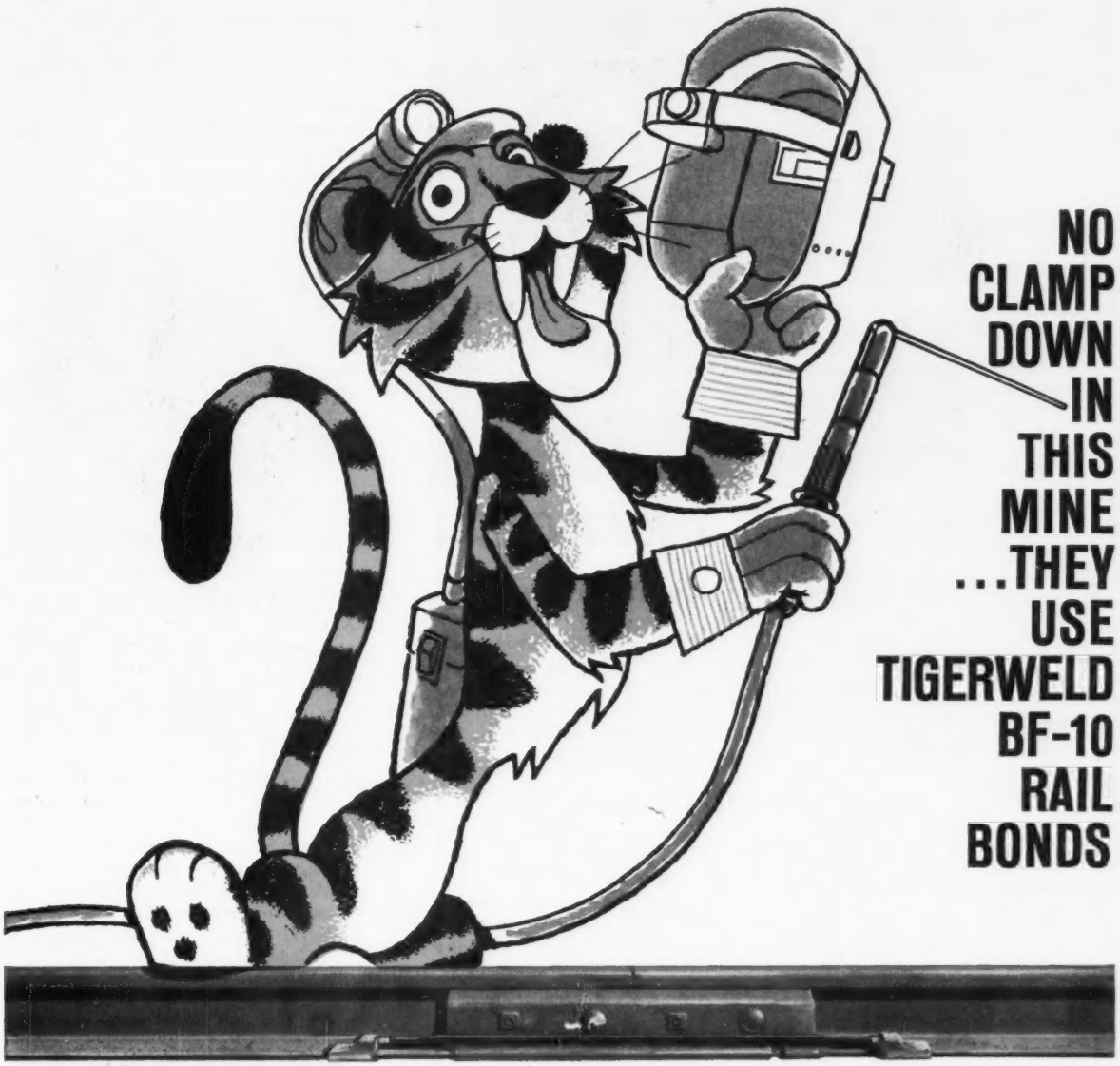
TEXACO

*Throughout the United States*
*Canada • Latin America • West Africa*

**AUGER DRILL**—Designed for auger drilling and coring and other uses, the Model MO-1 rig is an efficient unit for drilling "blind holes" where there is no return of cuttings either by air or fluid circulation. Basic features include a traveling head, mechanically driven, a chuck for conventional rotary drilling and a hydraulic pulldown. The unit is designed for one-man operation. If desired, a circulating pump may be mounted on the drill. Rated to drill 5-in holes to 100 ft, the MO-1 rig has a stationary mast and provides a 5½-ft stroke for use with 5-ft augers. George E. Failing Co., Enid, Okla.



**DIAPHRAGM VALVE**—A new straight-flow diaphragm valve is said to combine the versatility of diaphragm valves with the greater flow capacity and packless design of gate valves. First production use of metal-to-rubber-to-fabric bonding, a technique developed for this product, is considered an outstanding design feature of the unit. Dia-Plug, as the valve is termed, will handle slurries and the like to 180 F and up to 150 psig, depending on size and choice of materials. Claimed advantages of Dia-Plug design, compared with weir-type diaphragm valves, include: (1) greater economy, (2) up to 60% greater flow capacity with less pressure drop,



# NO CLAMP DOWN IN THIS MINE ...THEY USE TIGERWELD BF-10 RAIL BONDS

A couple of taps will hold this rail bond in position so you can weld without clamps and trouble. You can use it two ways, above the track base or below for maximum protection. Either way the BF-10 stays put while you weld. Tigerweld BF-10 bonds can be reclaimed and used again. Tough steel terminals, flash butt-welded to a rugged strand, make this bond durable. You get a reliable, low-resistance connection that will give years of trouble-free service.

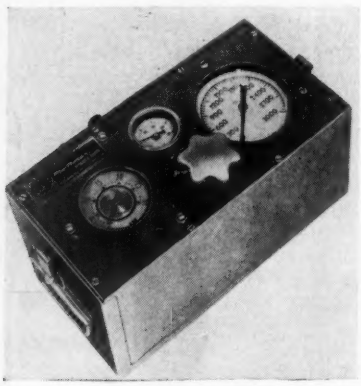
There's a USS Tigerweld Rail Bond for every conceivable mining application. All are built with butt-welded terminals so they can take abuse and still give long, dependable service. Write for our book, "Tigerweld Power Bonds," American Steel and Wire, Dept. 1417, Rockefeller Building, Cleveland 13, Ohio.

*USS and Tigerweld are registered trademarks*

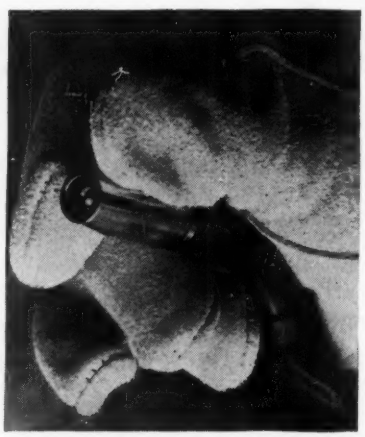
**American Steel and Wire Division of United States Steel**

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, Distributors Abroad

(3) overclosing will not rupture diaphragm, (4) better throttling characteristics, (5) more positive closure, and (6) cost less to operate and maintain. Sizes range from ⅜- to 8-in. dia. The new valve is the result of collaboration between Cryogenics Corp., Meadville, Pa., and Ohio Rubber Co., Willoughby, Ohio.

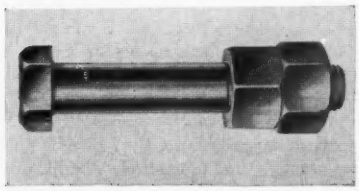


**TESTING HYDRAULIC TROUBLES**—A portable testing instrument for quickly and accurately locating the source of trouble in a malfunctioning hydraulic system is identified as the "Flo-Rater." The new instrument—OTC No. Y-3000—is designed for testing hydraulic systems which deliver up to 30 gpm and 3,000 psi. By measuring flow at various pressures in any part of the system and indicating quickly and accurately whether or not a component is functioning properly, it eliminates all guess work in "trouble-shooting" hydraulic systems. Weighing 40 lb, it measures 14⅞x7x10½ in. Owatonna Tool Co. 652 Cedar St., Owatonna, Minn.



**WELDING TORCH**—The ability to turn nozzle 360 deg and keep the handle (and operating switch) in the most efficient operating position is one feature of the new 22-oz air-cooled straight-through torch. Model HT-1 is the business end of a new semi-automatic 200 amp portable welding system recently

introduced by Westinghouse. Rated 100% duty cycle at 200 amp, the lightweight gun accommodates wire sizes .030 to .047 in and uses $CO_2$ in the reactor and spray ranges; argon or argon gas mixes in the reactor range. Drive control provides speed up to 1,170 in per min. Westinghouse Electric Corp., Westing-Arc Dept., Buffalo 5, N. Y.



**BOLTS**—A new bolt called "Sur-lok" featuring right and left turn nuts on the same thread has been introduced to industry. Because the nuts work in opposite directions they are automatically self-locking and are a solution to the expensive bolt-loosening problems caused by vibration. Vibration only tightens the lock; loosening is impossible.

Since the strength of a bolt and nut is determined by the strength of the thread, an additional feature of Sur-lok is added strength over ordinary bolts because of the double-thread design. All sizes for all applications are offered. U.S. Manufacturing and Sales, Inc., 550 Grant St., Pittsburgh 19, Pa.

## Equipment Shorts

**Measuring Moisture in Coal** — The Rogers moisture control system, installed on a belt conveyor or side stream, will measure and record, continuously and instantaneously, the moisture content of coal, reports the manufacturer of this device. In addition, the further use of this system as a control element to regulate drying and tempering operations gives automatic and continuous control of moisture at the desired level. Installations on coal, as well as a variety of other products, are giving correlations with laboratory analyses as close as plus or minus 0.25% according to the company. Engineering Management, Inc., 18 South Northwest Highway, Park, Ridge, Ill.

**Rebuild Kit**—Another front-end section rebuild kit, this one featuring design of the recently-introduced International D-400 and DB-400 series of conventional heavy-duty trucks, is now on the market. With these kits almost any make or model of heavy-duty truck using a diesel engine now available as a standard production item in an International 400 series chassis can be converted to a truck as modern in appearance as the newest International models. They are offered for models from 30,000 lb gvw and 68,000 lb gcw and up, for conventional or COE chassis, and four or six-wheel models. International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill.

**Oil Condition Indicator** — Prompt recognition of lubricating oil contamination in diesel or gasoline engines is the prime mission of the newest Gerin Oil Condition Indicator. This engine-mounted meter gives readings on condition of the oil automatically. It tests the oil at engine-operating temperature instead of room temperature and can be read while engine is stopped or running, staying accurate under adverse conditions of weather and vibration. With the new dial zones, even the least experienced man who checks the dip stick oil level can at the same time check the oil condition by a glance at the meter. When the black point is at 100% on the dial, the oil is safe for continuing use. Whenever it is in one of the zones, specific recommendations printed on the face tell him what this means. The meter is reported to measure 2x4x5½ in. The Gerin Corp., Avon, N. J.

## Free Bulletins

**Lubricating Chain** — "Redi-Lube" roller chain lubricates itself. This self-lubricating feature is achieved by a heavy, oil-impregnated, sintered-steel bushing that replaces the conventional roller and bushing of standard roller chain. Bulletin 6117 gives details, Chain Belt Co., 4786 W. Greenfield Ave., Milwaukee 1, Wis.

**Magnetic Separators**—A complete line of permanent magnetic drum separators used for automatic separation of iron contamination from bulk materials is described and illustrated in Bulletin B-54-1B. Containing specific information on separators from 12- to 36-in diameters and widths from 8 to 60 in, the booklet includes principles of magnetic drum operation and shows how to select correct separating units. Eriez Mfg. Co., Erie 6, Pa.

**Bearings**—Bulletin 7104—"Bearings"—covers all sizes and styles of "Life-Lube" permanently-lubricated, ball-bearing pillows blocks, flange units and take-up units as well as porous-bronze and babbitted pillow blocks. T. B. Wood's Sons Co., Chambersburg, Pa.

**Loader**—Designed for 9,000-lb operating capacity with a wide range of reach and dump height, the new Lorain ML-309 Moto-Loader is described and illustrated in Bulletin 86780-1. Thew Shovel Co., Lorain, Ohio.

**Boring Unit**—The Ka-Mo G-16, a gasoline-powered earth-boring unit for drilling 2¾ to 12 in holes, is the subject of 4-p Bulletin G-16. Kwik-Mix Co., Port Washington, Wis.

**Seismic Timer** — The Model R-117 Seismic Timer locates rock strata, hardpan and water tables at depths up to 100 ft using seismic shock waves generated by a special hammer impact or by small explosive charges. A bulletin with complete information is offered by Soiltest, Inc., Sub. of Cenco Instruments Corp., 4711 W. North Ave., Chicago 39, Ill.

**Hardfacing**—Bulletin B-175A tells how to apply tungsten-carbide hardfacing and covers four forms of Kennametal hard surfacing materials. Kennametal Inc., Latrobe, Pa.

**Solid Lubricants**—The theory and use of solid lubricants are thoroughly discussed in "Breaking Lubrication Barriers" (Bulletin 132) just published by Alpha-Molykote Corp., 65 Harvard Ave., Stamford, Conn.

**Hoists and Binders**—Advantages of using the Coffing line of hoists and binders are set forth in Bulletin AD-123 which also includes specification and dimension charts. Coffing Hoist Div., Duff-Norton Co., Four Gateway Center, Pittsburgh 22, Pa.

**Front-End Loaders**—Two new full-color bulletins are offered covering Eimco front-end loaders. Bulletin L-1174 covers the Eimco 126 and Bulletin L-1175, the Eimco 123. Eimco Corp., P. O. Box 300, Salt Lake City 10, Utah.

**Drilling**—Two new pieces of literature covering diamond bits and reaming shells including Selector Charts, and on development and use of core barrels in diamond drilling are Bulletins B-3100 and L-3001, respectively. E. J. Longyear Co., Longyear Bldg., Minneapolis 2, Minn.

**Electrical Tapes**—A short form catalog, complete with laboratory specifications, is said to fully answer the information needs of all electrical-tape users as well as vendors. Tape Div., Plymouth Rubber Co., Inc., Canton, Mass.

**Cleaning Idlers** — Developed for toughest-service conditions on conveyors handling coal and other materials, the Belt Saver Cleaning Idler is an unusual assemblage of resiliently-deformable material mounted spirally to produce cleaning action removing granular particles from conveyor belts. Catalog Section CI-961 gives complete information. Webster Mfg., Inc., Tiffin, Ohio.

# Among the Manufacturers

Changes in top-echelon posts have been announced by **Colorado Fuel & Iron Corp. Leonard C. Rose,** formerly executive vice president, moves up to president and director, succeeding **Alwin F. Franz,** who becomes chairman of the board. Mr. Franz, who has been president since 1952 and who has reached his 65th birthday, in turn, succeeds **Charles Allen Jr.** Mr. Allen who held the Chairman post since 1945 will maintain his close association with the corporation as chairman of the executive committee.

New executive assignments at **Long-Airdox Co.** went to **Paul C. Manley** as vice president and general manager and **Robert C. Nelson** as vice president of sales. Mr. Manley was formerly vice president of the Airdox Co. (predecessor to the present firm) in charge of activities related to coal mining.

In addition, Long-Airdox named two new divisional sales managers. They are **W. R. Hennessey** for the Western Division and **W. E. Meador** for the Eastern Division. Mr. Hennessey will headquarter at 307 N. Michigan Ave., Chicago, Ill., while Mr. Meador will work out of Oak Hill, W. Va.

**Barton M. Collinge** has been appointed manager of the New York district, explosives and mining chemicals department, **American Cyanamid Co.** He will be located at department headquarters in Bound Brook, N. J.

**Nortons-Tividale Ltd.** of Tipton, Staffordshire, England, has established a new U. S. sales-engineering organization at 307 N. Michigan Ave., Chicago 1, Ill.

The firm manufactures a complete line of coal preparation equipment including the Norwalt dense-medium separator (See equipment item on p 128) and the Norton jig washer. The Norton jig, originally introduced in the U. S. in 1931 and subsequently manufactured under license here, is now available through the new organization.

**E. C. Griggs** has been chosen to head the U. S. setup as manager. He comes to his new post from Roberts & Schaefer, after having served many years as district sales manager for McNally-Pittsburg Mfg. Co. "Clint"—as he is known to the trade—has had some 40 yr experience in the coal and mining industry.

**Harold A. Zell,** manager, mining sales, **Firth Sterling Inc., Carbide Div.,** has been made general manager of **Firth Sterling (Canada) Ltd.** at Brantford, Ontario. Having joined the firm 20 yr ago, he spent the first 9 yr in carbide engineering and design and became associated with their Mining Sales Div. in 1950.

Two promotions in the sales and production departments have been announced by **Whitmore Mfg. Co.,** Cleveland, Ohio. **William E. Bretschneider,** sales manager since 1957 and a member of the Board of Directors since 1959, has been appointed vice president—sales. Second promotion is that of **William C. Beaser** from works manager to vice president—production. A member of the Board of Directors since 1958, Mr. Beaser has a background of 28 yr in the development and manufacture of special lubricants.

**John H. Fleming** has been named technical services manager, **Coal Machinery Div., Joy Mfg. Co.,** with headquarters in Franklin, Pa. Joy also announced the appointment of **Glenn McDowell,** formerly sales representative in the Utah area, as sales specialist for chain products. His base of operations will be the Joy warehouse at Meadowland, Pa.

# COAL AGE

## January to December 1961
## Index to Volume 66

The articles and references compiled in this index have been listed alphabetically. A subject related to a major topic has been listed under the major topic. For example, an article dealing with a new mining machine and its operation will be found under the topic, "Mechanization." An article on shuttle cars will be found under "Transportation." Unclassified articles, or those that cannot be placed in any major category, have been listed within the index alphabetically. Editorials, marked (E), will be found under the subject with which they are concerned. Many titles are abbreviated to give prominence to important words.

# GENERAL INDEX

(E)-*Editorial;* (CC)-*Coal Commentator;* (N)-*News;* (OI)-*Operating Ideas;* (FF)- *Foremen's Forum*

# Coal Age Index, Vol. 66, January, December, 1961

# Coal Age Index, Vol. 66, January, December, 1961



## N



## O



## P



## R



## S

# Coal Age Index, Vol. 66, January, December, 1961



# COMPANY INDEX

## Coal Age Index, Vol. 66, January, December, 1961

# AUTHOR'S INDEX

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POSITION WANTED undisplayed rate is one half of above rate, payable in advance.
BOX NUMBERS count one additional line.

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GAVENDA BROTHERS, INC.
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*ADDRESS BOX NO. REPLIES TO: Box No. Classified Adv. Div. of this publication. Send to office nearest you.*
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**Industrial Engineer experienced in coal mining.** Preferably with college degree. Excellent opportunity. P-7911, Coal Age.

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| 25 | West. T.E.F.C.B.B. —XP—n | SK-83.8 | 1800 |
| 25 | West. T.E.F.C.B.B. | SK-93 | 1200 |
| 5 | West. T.E.F.C.B.B. n | SK-254 | 1800 |
| 3 | West. T.E.B.B. —XP—n | SK-225 | 1800 |
| 2 | West. T.E.F.C.B.B. n | SK-224 | 1800 |
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n = new

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1—112G-3 Goodman Cutting Machine.

### LOADING MACHINES, 250 Volts DC

1—14BU-7RBE Joy Loaders, excellent condition.
1—14BU-7RAE Joy Loader
1—14BU-7BE Joy Loader
6—12BU-9E Joy Loaders
10—11BU-10APE Joy Loaders, completely modern.
4—8BU Joy Loaders
3—7BU Joy Loaders
1—18HR Joy Loader
3—360 Goodman Loaders

### SHUTTLE CARS, 250 Volts DC

7—10SC Joy Shuttle Cars, right & left hand drive.
2—60E-10 Joy Shuttle Cars, modern.
2—6SC-7E Joy Shuttle Cars, modern.
1—6SC-5E Joy Shuttle Car, modern.
2—42E-18 Joy Shuttle Cars, completely modern.
1—32E-7 Joy Shuttle Car.
2—10SC-1F Joy Shuttle Cars, 500 Volt DC.
3—Model 48 TorKar Shuttle Cars.
1—32E16 Joy Shuttle Car

### CUTTING MACHINES, 250 Volts DC

6—10RU Joy Cutting Machines—excellent
1—512 EJH & EJ Goodman Cutting Machines.
2—29UC Jeffrey Universal Cutters.
2—29LC Jeffrey Top Cutters.
5—35B Jeffrey Cutters.
6—35BB Jeffrey Cutters.
5—35L Jeffrey Cutters.
1—7AU Sullivan Cutter.

### RECTIFIERS, 275 Volt DC, Primary 2300/4160

1—300 KW General Electric Portable Rectifier
1—400 KW American Selenium Rectifier

### MOTOR GENERATORS—250 & 275 Volts DC

1—300 KW, G.E. MG Set, primary 2300/4160, 1200 RPM
1—G.E. 200 KW MG Set, primary 2300/4160, 1200 RPM
1—200 KW Westinghouse MG Set, primary 2300/4160, 1200 RPM
1—150 KW Westinghouse MG Set, primary 2300/4160, 1200 RPM
1—300 KW Westinghouse MG Set, primary 2300/4160, 1200 RPM
1—150 KW General Electric Motor Generator Set, 440 Volt AC, 275 Volt DC.
3—50 KW G.E. MG Sets, primary 2300/4160, 1200 RPM

### DIESEL PLANTS

1—75KW Diesel Gen. Set, 250 V. DC with 671 GM Engine.
1—D13000 Caterpillar Diesel Gen. Set with 75KW, 220 V. AC Generator.
1—100 KW Superior Diesel Gen. Set, 275 V. DC
1—75KW Buda Diesel Gen. Set, 275 V. DC.

### ROTARY CONVERTERS, 275 Volts DC, Primary 2300/4000

1—300 KW Westinghouse, Pedestal Type
1—100 KW G.E. HCC-6, 1200 RPM, Pedestal Type
1—200 KW. G.E. HCC-6, 1200 RPM, Pedestal Type

### BELT CONVEYORS

1—36" Barber Greene Lattice Frame Conveyor, 80' long.
1000'—26"—97C Goodman Belt Conveyor, complete.
1—MTB-30 Joy Belt Head & Tails, only.
1000' Joy MTB-26 Conveyor, complete—excellent.
3—MTB—26" Joy Heads and Tails, complete.

### CHAIN CONVEYORS

1—350' LaDel Conveyor Line, complete
2—61AM Jeffery Conveyors—300' long.
1—61HG Jeffrey Chain Conveyor, 40' long.
1—Jeffrey 300'—15" Chain Conveyor.

### LOCOMOTIVES

1—G.E. 6 Ton Locomotive w/Reel, 36" gauge.
1—1030 Goodman Locomotive, 24" high, 44 " gauge.
1—13 Ton Goodman—Type 81A04T, Modern.
1—Goodman 13 Ton 136B-0-4-B w/75 HP Motors.
2—13 Ton Jeffrey Locomotives
1—Goodman 5 Ton 3012 with 50 HP Motor.
4—8 Ton 132AK42-48R Goodman w/2—50 HP Motors.
1—8 ton 32-0-4-T Goodman with 2—50 HP Motors.
1—8 ton LM2-8-T.DD G.E. with 2—50 HP Motors.
3—6 ton LM2-T-6MM G.E. with 2—35 HP Motors.
2—6 ton LM2-4-6-11 G.E. with 2—35 HP.
3—Greensburg Monitors complete charging equipment.

### ELEVATING CONVEYORS

5—PL11-16RPE Joy Elevators.

### CRUSHERS

1—36"x36" Double Roll Crusher with 100 HP Motor.
1—Robins 36"x36" Double Roll Stoker Crusher.
1—Pa. Single Roll Crusher—24"x40"
1—McNally Pittsburg 24"x36" Stoker Crusher w/new segments.
1—American Pulverizer 26"x42", 200 tph—#AC-3B
1—American Pulverizer 24"x24", 30 tph—#WC-24
1—American Pulverizer 24"x30", 75 tph—#WC-30
1—American Pulverizer 36"x30", 100 tph—#AC-30-S.

### MINE CARS—42" GAUGE

19—Sanford Day 3 Door Drop Bottom Cars, 36" high.
24—AC&F 3 Door Drop Bottom Cars, 34" overall height without 10" sideboards
173—AC&F Drop Bottom Cars, 48" high, new condition.
5—Mantrip Cars.

### COMPLETE FOUR TRACK TIPPLE

1—CMI 48" Dryer with motors, drives, belt, etc., screen cloth 1/16" opening, capacity 90 tph.
1—Coppus Ventair Blower.
5—8x16 Allis Chalmers Pumps with motors.
1—16x14 Allis Chalmers Centrifugal Pump, complete.
1—Roberts & Schaefer Eleptic Vibrator.
1—Roberts & Schaefer Air Drying Plant, complete.

### MOBILE EQUIPMENT

1—Koehring Heavy Duty Crane
1—Shovel Dipper Stock for same, 16' long, ¾ yard dipper.
1—1950 International Flat Bed Tandem Truck.
1—Allis Chalmers Tractor Hi-Lift.
1—Caterpillar Tractor D-6, 60" Gauge.

### MACHINE TRUCKS, 250 Volts DC

2—T2-5APE Joy Machine Trucks.

### COAL DRILLS

25—CP-472 Electric Coal Drills, 250 Volts DC.
5—CP-572 Coal Drills, 250 Volts DC.
10—Chicago Pneumatic Little Giant Coal Drills, 220 Volts AC.
2—CD-22 Joy Coal Drills, 250 Volts DC.
5—Dooley Self-Propelled Drill Trucks, twin-armed, track or rubber.

### ROOF BOLTING MACHINES

### HOISTS

10—Vulcan-Denver #11½ Material Hoists w/-motors.
1—Brownie Hoists, 5 HP, AC
1—Brownie Hoist, HKO, good condition.

### COMPRESSORS

2—Acme Self-Propelled Air Compressors, Model 168.

### ROCK DUSTERS

2—Manson 24-S Wet Rock Dusters.
2—MSA Rock Dusters, 25 H.P. Track
2—MSA Bantam Rock Dusters, rubber tired.
1—American Mine Door Rock Duster, 22" high.

### FANS

1—Jeffrey 8H-42 Aerodyne Fan complete w/motor, "V" belt & tubing.
1—Jeffrey 8H-60 Aerodyne Fan complete w/G.E. 100 H.P., 440 V. AC Motor & Auxiliary Ford Industrial Power Unit.

### CONTINUOUS MINERS

2—1CM Joy Continuous Miners, 250 Volts DC.
1—Goodman Continuous Boring Machine, 440 Volts AC, 250 HP, can be converted to twin borer.
1—5JCM Joy Continuous Miner with self-tramming and extensible belt, 440 Volt AC complete with 1000 ft. of structure and belting.

### MISCELLANEOUS

20—40 lb. Switches, complete.
20—60 lb. Switches, complete.
1—American Mine Door Automatic Electric Throw Switch.
1—75 HP Starter for AC Wound Rotor Motor, drum type complete with resistance.
3—2300/4160 Y—230-115 Volt—200 KVA G. E. Transformers.
3—2300/115/230 Volt—15 KVA G.E. Transformers,
1—4x10 Double Deck Vibrating Screen.
1—Nolan Portafeeder, complete.
1—Canton Track Cleaner, 42" gauge.
1—5" Pomana Deepwell Pump
1—Manson Mine Jeep, 40" gauge.
1—CY-21 Reel and Motor, complete.
2—Lincoln 300 amp. MG type DC Welders
2—Hobart 300 amp. MG Type DC Welders
4—Guyan Resistance Bonder Welders.
495 ft.—1/9 Conductor 5000 Volt Rubber Covered Cable w/ground.
2000 ft.—2/0-3 Conductor 2300 Volt Rubber Covered Bore Hole Cable.
3000 ft.—4/0-3 Conductor 5000 Volt Trench Cable.
4000 ft.—2/0-3 Conductor 5000 Volt Trench Cable.
AC and DC motors ranging from 1 to 100 H.P.
Complete inventory of new parts for 10SC, 10RU and 11BU Joy Equipment. Hundreds of other items such as pumps, motors, armatures, locomotive trucks, wheel units, hydraulic pumps, conveyor chain, cat chains, tipple draglines, etc., too numberous to list.

ALL EQUIPMENT LISTED AND HUNDREDS OF OTHER ITEMS ARE IN STOCK AND MAY BE INSPECTED AT OUR SHOP AND EQUIPMENT YARDS LOCATED AT RALEIGH, WEST VIRGINIA AND O'FALLON, ILL.

# MOUNTAIN STATE EQUIPMENT COMPANY

Beckley, West Virginia, P. O. Box 1050, Phone CL 3-7383

J. J. Mahoney, Res. CL 3-6804 • W. R. Monk, Res. CL 3-6907
R. E. Kamm, Summersville, Res. 4281

O'Fallon, Illinois, P. O. Box 150, Phone ME 2-3621

Roy Fairchild, Res. ME 2-5881
J. J. Mahoney

# SEARCHLIGHT
## Equipment Locating Service

*No Charge or Obligation*

This service is aimed at helping you, the reader of "SEARCHLIGHT" to locate Surplus New and used coal mining equipment not currently advertised. (This service is for USER-BUYERS only). How to use: Check the dealer ads to see if what you want is not currently advertised. If not, send us the specifications of the equipment wanted on the coupon below, or on your own company letterhead to:

**Searchlight**
**Equipment Service**
**Classified Advertising**
**c/o COAL AGE**
**P.O. Box 12, N.Y. 36, N.Y.**

Your requirements will be brought promptly to the attention of the equipment dealers advertising in this section. You will receive replies directly from them.

---

**Searchlight Equipment Locating Service**
**Classified Advertising**
**c/o COAL AGE,**
**P. O. Box 12, N. Y. 36, N. Y.**

Please help us locate the following equipment.

NAME_____
TITLE_____
COMPANY_____
STREET_____
CITY_____
ZONE_____ STATE_____ 12/61

# NO GIMMICKS — NO GIVE-AWAYS

**BUT THE TRUTH IS . . . We have a tremendous stock of mining equipment that we are anxious to sell at bargain prices. WE OWN WHAT WE ADVERTISE . . . All types of Joy Cutters, Loaders, Shuttle Cars, Cat Trucks, Belt Conveyors, Chain Conveyors, etc. Includes**

## JOY EQUIPMENT—REBUILT

2—Joy 14BU 9AE Super Loaders—28″ Hi—New 1958.
2—Joy 14BU Loaders, low pedestal, 7AE, 1956 & 57.
4—Joy 14BU Loaders, medium pedtstal, 7RBE.
2—Joy 14BU 7CE high pedestal loaders.
4—Joy 14BU 3PE Loaders.
2—Joy 12BU Loaders complete with Piggybacks.
2—Joy 12BU Loaders, 9E, latest type, 250 V. DC.
3—Joy 12BU Loaders, 220/440 Volt AC.
1—Joy 20BU Loader, latest type.
4—Joy 11BU Loaders, latest type.
1—Joy 8BU Loader, 34″ overall height.
1—Joy 8BU Loader, 220 V. AC.
1—Joy curved Bar Head for 14BU, complete.
6—Reliance 24-J Motors, 7½ H.P.
4—Reliance 38-J Motors, 10 H.P.
2—Reliance 40-J Motors, 15 H.P.
20—Reliance 9-J Motors, 4 H.P.
1—Goodman 660 Loader on Crawlers, excellent 250 V. DC.
1—Goodman 665 Loader on Crawlers, latest type 250 V. DC.
1—Goodman 865 Loader, 26″ hi. 250 V. DC.
4—Joy 8SC Shuttle Cars, 26″ hi. rebuilt.
5—8SC Shuttle Cars, as removed from service. 26″ hi.
4—Joy 6SC Shuttle Cars, rebuilt, latest type.
6—Joy 6SC Shuttle Cars, as removed from service.
1—Joy 5SC Shuttle Car. Excellent.
2—Joy 32E9 Shuttle Cars.
2—Joy 32E10 Shuttle Cars, rebuilt.
6—Joy 32E15 Shuttle Cars, rebuilt.
4—Joy 32E16 Shuttle Cars, rebuilt.
16—Joy 42E16 Shuttle Cars, rebuilt and as is.
1—Joy CD-22 Drill, on rubber, like new.
6—Joy T-2-5 low pan Crawler Trucks, rebuilt.
1—Joy T-2-6 low pan Crawler Truck with reel.
2—Joy T-1 Standard Crawler Trucks, 220 AC.
1—Joy T-1 Standard Crawler Truck, 250 DC.
4—Joy 11-B Cutting Mach., like new, 35 & 50 H.P.
4—Joy 7-B Cutting Mach., like new, 250 & 500 V.
4—Goodman 212 Cutting Machines, 19″ high.
2—Goodman 312 Cutting Machines, 17″ high.
2—Goodman 412 Cutting Machines, 19″ high.
1—Goodman Machine on Crawler, 31″ high. All hydraulic.
6—Goodman 512 Machines with Bugdusters. Rebuilt and as removed from service.
6—Goodman 612 Cutting Machines, 250 and 500 volt.
1—Jeffrey 70 URB rubber tired Cutter, Universal head, perfect condition.
1—Joy 11RU Rubber Tired Cutter with Bugdusters, Universal head, dual tires, like new, 250 V. DC.
1—Joy 10RU Rubber Tired Cutter, Universal head, 250 V. DC. Rebuilt or as is.
1—Goodman 2400 Rubber Tired Cutter, like new, Universal Head, 34″ overall height.
1—Sullivan 7AU on Dual Rubber Tires, 250 V. DC.
6—7AU's on track. Universal head.
2—Jeffrey 29UC Cutting Machines, Universal head, cuts anywhere in seam, 38″ high, on Crawlers, 250 volt D.C.
4—Jeffrey 29LC on Crawlers, rebuilt or as removed from service.

## LOCOMOTIVES

1—Goodman 6 tons, 93-A, 27″ hi, armor plate frame.
1—Jeffrey 15 ton MH-77 Locomotive, armor plate frame.
7—Jeffrey, 13 ton, Type MH-110, 36″, 42″, 44″ ga.
2—Jeffrey, 10 ton, type MH-110, 42″ and 44″ ga.
2—Jeffrey, 10 ton, type MH-78, 42″ and 44″ ga.
2—Goodman 8-30 and 10-30 Locos., 26″ above rail.
1—Jeffrey MH-150, 6 ton, 26″ overall height, rebuilt with reel.
12—Jeffrey, 6 ton, type MH-88, 42″, 44″ and 48″ ga.
4—Jeffrey, 8 ton, type MH-100 2½″ armor plate frames.
3—Jeffrey, 4 ton, type MH-96, 42″, 44″, 48″ ga.
1—G.E., 4 ton, type 825 Locomotive, 22″ high.
10—G.E., 6 ton, types 801, 803, 821 Locomotives, 42″, 44″ and 48″ ga.
1—G.E., 8 ton, type 822 Locomotive, 44″ ga.
3—G.E., 10 ton, type 809 Loco., 42″, 44″, 48″ ga.
2—G.E., 13 ton, type 829 Loco., armor plate frames.
2—G.E., 12 ton, type 830 Locomotives, excellent.
2—Goodman, type 33, 6 ton, 44″ and 48″ ga.
3—Westinghouse, type 902, 4 ton, 42″ and 48″ ga.
1—Atlas Battery Locomotive 36″ ga.
1—Atlas Trolley Locomotive, 4 ton, 24″ high.
2—Westinghouse, type 904, 6 ton, 44″ and 48″ ga.
2—Westinghouse, type 906, 44″ and 48″ ga.
2—Westinghouse, type 907, 10 ton, 44″ & 48″ ga.
3—Westinghouse 908, 13 ton, Loco., 42″ & 48″ ga.
8—Jeffrey MH-78 Locomotive Units, cheap.
4—Jeffrey MH-88 Locomotive Units, real bargains.
6—Jeffrey MH-100 Locomotive Units, reasonable.
3—Plymouth Diesel Locomotives, 8 and 10 tons, 42″ and 44″ ga.
Locomotive Trucks & Spare Armatures for the above.

## TIPPLE EQUIPMENT

1—All Steel 5 Track Tipple, new 1957, complete with washer, silo, oil treating system, all bolted construction.
1—Complete Five Track Tipple with Washers and Air Tables.
1—C-M-I Dryer.
1—Complete stoker plant, all steel.
2—Complete tipples, 3 & 5 track, steel and wood.
3—Cleaning Plants, 1 Ea. McNally, Roberts and Schaefer, Jeffrey, Washers and Air-Flo Tables.
4—Complete Aerial Trams for coal or refuse.
3—Complete Rope and Button Lines.
2—Monitor Lines complete with Drums, excellent.
1—Allis-Chalmers 5′ x 12′ Rippflo Vibrator.
1—Allis-Chalmers 4′ x 12′ Low-Head Vibrator.
1—Robins Gyrex Vibrator, 4 x 10.
10—Belt and Apron type Loading Booms.
6—Shaker Screens.
1—Robins Car Shakeout.
1—Gundlach Crusher, like new.
20—Crushers, various sizes—Jeffrey, Link-Belt, McLanahan & McNally.
4—Mine Scales, 10 & 20 ton.
5—Truck Scales, 25 to 40 ton, New & Used.
Feeders, Belt and Drag Conveyors, Car Retarders.

## CUTTING MACHINES

1—Joy 10RU Rubber Tired Cutter, Universal head, 250 V. D.C. As is or rebuilt.
1—Joy 11RU Rubber Tired Cutter, 250 V. D.C.
1—Goodman 2400 Rubber Tired Cutter, like new, Universal Head, 34″ overall height.
2—Jeffrey 29UC Universal Machines on Crawlers.
1—Goodman on Crawlers, 31″ overall height.
4—Baby Goodman 212's, rebuilt, 250 V. D.C.
2—Goodman 312 Cutting Machines, 17″ high.
3—Goodman 412 Cutting Machines, 19″ high.
6—Goodman 512's, with Bugdusters, like new.
4—Goodman 512's, rebuilt, or as removed from service.
6—Goodman 612's—250 & 500 Volt.
3—Goodman 112's, 220/440 V. A.C.
4—Joy 7-B Cutting Machines, 250 and 500 Volt.
4—Joy 11B Cutting Machines, rebuilt, 35 & 50 H.P.
1—Sullivan Dual Rubber Tires, 34″ high, Universal Head.
6—7AU's, on track, Universal Head.
10—Goodman 12AA's and 112AA's, 250 V. D.C.
2—Goodman 324 Slabbers.
2—Goodman 724 Slabbers.
2—Goodman 824 Slabbers.
6—Jeffrey 35L's, like new, 250 V. D.C., 17″ high.
2—Jeffrey 35L's, on low vein trucks.
1—Jeffrey 35BB, 220/440 A.C.
15—Jeffrey 35B's and 35BB's 250 V. D.C.
2—Jeffrey 29B's on track.
10—Jeffrey 29C's, track mounted.
2—Jeffrey 29L's, on Crawlers. Excellent.
4—Sullivan CE7, 220/440 V. A.C.

## CONVEYORS

1—Each 30″ and 36″ Joy 1000′ extensible belt, latest type, like new.
1—Goodman 97HC 30″ Rope Belts, 1000′ perfect. With or without rubber.
1—Jeffrey 52-B tandem drive 30″ and 36″ Belt Conveyor, 600′ to 2000′.
1—Joy 30″ Underground Belt Conveyor, Excellent.
2—Barber-Greene 30″ and 36″ Belt Drives, like new.
2,000′ 52-B Belt Structure, 30″.
1,000′ Conveyor Belt, 42″.
1,500′ Conveyor Belt, 36″.
2,000′ Conveyor Belt, 30″.
1,000′ Conveyor Belt, 26″.
8—Jeffrey 61AM 12″ Chain Conveyor, 300′.
2—61EW Elevating Conveyors.
2—61WH 15″ Room Conveyors, 300′.
2—Joy 15″ Room Conveyors, 300′.
2—Joy 20″ Conveyors, 300′.
4—Joy Ladel UN-17 Shakers.
10—Goodman G-12½ and G-15 Shakers.
1,000′ Goodman 18″ Flat Belt Conveyors, tandem drive any length. Perfect.

## CONVEYORS AND DIESEL PLANTS

1—300KW G.E. Stationary Rectifier.
2—500KW G.E. Stationary Rectifiers.
4—1,000KW Stationary Rectifiers.
2—100KW, G.E. TCC-6's, 275 V., Rotary Converters.
1—150KW, G.E. HHC-6, 275 V., Rotary Converter.
1—150KW, 6 phase, Allis-Chalmers Rotary Converter, 275 V. D.C.
2—200KW G.E. HCC-6's, Rotary Converters, 275 V. D.C. Steel frames. Newly rewound.
3—300KW G.E. HCC-6's, Rotary Converters, 275 V. D.C. Like New.
2—300KW Westinghouse, 6 phase, Rotary Converters, 275 V. D.C.
2—500KW G.E. HCC-6 Rotary Converters, 275 V. D.C.
1—200KW Westinghouse Rotary Converters, 275 V. D.C. Newly rewound.
(All the above with 6900/13000 and/or 2300/4000 primary transformers)
1—50KW MG Set, 220/440 A.C., 275 V. D.C.
1—100KW MG Set, 275 V. D.C.
6—150KW MG Sets, G.E. and West., 275 V. D.C.
2—200KW MG Sets, West., rebuilt, 275 V. D.C.
1—200KW MG Set, G.E., perfect, 275 V. D.C.
2—300KW G.E. MG Sets, like new.
3—300KW Westinghouse MG Sets, 275 V., rebuilt.
1—300KW Westinghouse, 600 volt MG Set, rebuilt.
2—500KW G.E. 275 volt MG Sets, 2300-4000 V. primary rebuilt.
2—200KW G.E. Rotary Converters, 600 V. D.C.
2—300KW West., 600 volt, 6 phase, Rotary Conv.
4—300KW G.E. Rotary Converters, 600 V. D.C.
1—500KW G.E. Rotary Converters, 275 V. D.C., 6 ph.
2—500KW Westinghouse, 600 volt, D.C., 6 phase, Rotary Converters.
2—500KW G.E., HCC-6's, Rotary Conv., 6 phase, 600 V. D.C.
1—GMC-671 Diesel w/75 & 110KW, 250 V. D.C.
1—Cat. 318 Diesel with 75KW Generator.
1—Int. UD-14 Diesel with 50KW, 250 V. D.C. Gen.
1—GMC-471 Diesel with 60KW, 250 V. D.C. Gen.
1—100KW Natural or LP Gas Engine with Generator.

## LOADING MACHINES

16—Joy Loaders, 14BU, 12BU, 8BU, 11BU, 20BU.
5—Joy 12BU9E Loaders, 220/440 V. A.C. Excellent.
3—Joy 12BU9E Loaders, latest type.
2—Joy 12BU with Piggyback Conveyors.
1—Goodman 865 Loader, 26″, on Crawlers.
1—Goodman 665 Loader, on Crawlers, rebuilt.
1—Goodman 660 Loader, on Crawlers. 250 V. D.C.
1—Goodman 460, on track, rebuilt, all hydraulic.
2—Jeffrey 61 CLR's on rubber, 26″.
3—Jeffrey L-500 Loaders.
2—Myers Whaley, No. 3 Automatic Loaders.
2—Clarkson Loaders, 26″ above rail.

## MISCELLANEOUS

1—Jeffrey 76-A ColMol, 220/440, perfect.
1—Joy 5 JCM Continuous Miner, 220/440, perfect.
150 Tons Copper 4/0 and 9 Section Trolley 1/0 2/0 4/0 Stranded. 500 MCM, 750 MCM—1,000,000 MCM Insulated.
1 Each 4′-5′ 6′ & 8′ Hi Pressure Joy & Jeffrey latest type fans.
1—Complete Five Track Tipple with Washers and Air Tables.
5—Complete Tipples, 3 to 5 Track. Wood and Steel.
Steel Trestles for drop bottom cars.
All Steel Armco Buildings.
20—Jeffrey Molveyors on rubber tires.
1—¾ Yard Shovel and Back-Hoe.
2—¾ Yard Crawler Cranes. Gas.
Battery Supply Tractors, Rubber Tired.
1—Cantrell Air Compressor on rubber tires.
10—Air Compressors, 1 H.P. to 40 H.P.
1—Joy self-propelled rubber tired comp., 240 cu. ft.
1—Acme self-propelled rubber tired compressor, 130 cu. ft.
40—Mine Pumps, all types.
1—Differential 40 Passenger Man-Trip Car.
6—MSA Rock Dusters.
Joy Roof Drills—Schroeder Coal Drills.
2—Phillips Carriers, 44″ and 48″ ga.
1—Barber-Greene self-propelled Bucket Elevator.
Pipe Plastic, Steel, Transit, all sizes 1″ to 6″.
25,000 Roof Bolts, all types.
300—Mine Cars, drop bottom, 42″, 44″, 48″, ga.
300—Mine Cars, 18″ hi., end dump, 42″, 44″, 48″ ga.
1—10 ton Mine Car Scale with Recorder.
4—Brown Fayro 15 HP latest type Hoists.
15—Brown Fayro HKL and HG Car Spotters.
1—Brown Fayro Hydraulic Car Spotter.
1—12 ton Differential Slate Larry.
Incline Hoists, 25 to 150 H.P.
Shaft Hoists to 700 H.P. Complete.
1—Jeffrey 5′, 6′ & 8′ Aerodyne Fans, Like New.
6—Storage Tanks, 6000, 8000, 10,000 gallons.
2,000 Five Gallon G.I. Cans, screw lids.
2,500 tons Relaying Rail, 25lb., 30lb., 40lb., 50lb., 60lb., 70lb., 90lb., 100lb.
500 MCM, 750 MCM, 1000 MCM, Bare & Insulated.
Thousands of feet of rubber covered three conductor cable. All sizes.
500—Transformers from 1 to 500 KVA, 110 to 13,000 primary volts.
400—Electric Motors, 3 to 250 H.P.
Huge Stock of Mine Supplies.
600—MSA Mine Lamps, Chargers, etc.
4—Mine Scales, 10 & 20 ton.
5—Truck Scales, 25 to 40 ton, late type.
Mack & International tandem dump trucks.
1—Hart Brothers 60″ Saw Mill, Perfect. Cheap.
THOUSANDS OF OTHER ITEMS.

**WE BUY — SELL — TRADE**

**PHONE PL 2-4400** — **J. T. FISH** — **LOGAN, WEST VA.**

# —ADVERTISERS IN THIS ISSUE—

***Indicates more product information may be found in company advertising appearing in COAL AGE 1961 July Mining Guidebook and Buying Directory Issue. Check your Guidebook index.**



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CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.




**ADVERTISING SALES STAFF**

**Gordon A. Mack**
**Advertising Sales Manager**

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McGraw-Hill Bldg., Copley Square, Congress 2-1160

**Chicago 11** ..... C. H. Chase, F. W. Roets
645 North Michigan Ave., Mohawk 4-5800

**Cleveland 13** ..... W. W. Forysiak
55 Public Square, Superior 1-7000

**Dallas 1** ..... J. G. Grant
1712 Commerce St., Riverside 7-9721

**Denver 2** ..... J. W. Patten
1700 Broadway, Alpine 5-2981

**Detroit 26** ..... F. W. Roets
856 Penobscot Bldg., Woodward 2-1793

**Houston 25** ..... F. E. Holland
Prudential Bldg., Rm. W-724, Holcombe Blvd., Jackson 6-1281

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1125 W. Sixth St., Huntley 2-5450

**New York 36** ..... R. W. Peckham
500 Fifth Ave., Oxford 5-5959

**Philadelphia 3** ..... W. A. Potter
6 Penn Center Plaza, Locust 8-4330

**Pittsburgh 22** ..... Wm. H. H. Ginder
4 Gateway Center, Express 1-1314

**Portland 4** ..... S. Hubbard
Pacific Bldg., Yamhill St., Capitol 3-5118

**St. Louis 3** ..... F. W. Roets
Clayton Tower, 7751 Carondelet Ave., Parkview 5-7285

**San Francisco 11** ..... W. C. Woolston
255 California St., Douglas 2-4600

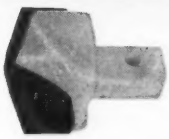
**Europe:**
**London W1, England** ..... E. S Murphy, Jr.
34 Dover Street, Telephone: Central 0911

**Frankfurt/Main, Germany** ..... S. Kimes
85, Westendstrasse, Telephone: 772665

**Geneva, Switzerland** ..... M. R. Zeynel
2 Place du Port, Telephone: 244274/75

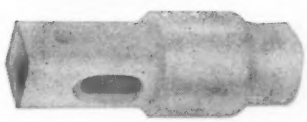

# Kennametal* FVH Bits

*DRILLING SPEED MAINTAINED . . . . .*



# Kennametal VAN Chucks

*DRILLING DUST CONTAINED . . . . .*



This Kennametal team gives you the *right* combination for fast, efficient roof drilling *plus* effective dust control. The Kennametal VAN chuck has an integral collar that traps dust in the slotted section through which the dust is drawn into the hollow drill steel. And the shorter shank and body of the Kennametal FVH bit minimizes the distance between point of penetration and vacuum slots — assuring a fast, smooth flow of cuttings.

The specially designed FVH bit has a flat bearing surface that gives it more support — resists breakage for longer bit life. There is a specific grade of Kennametal carbide to provide the most efficient drilling of any roof formation.

Drill steels have heat-treated, prefabricated chucks and shanks for maximum strength. Pin holes are located at right angles to the dust removal slots to avoid impeding the flow of dust.

For more information on how the superior performance of Kennametal FVH bits and drill steels can help improve production and profits at your mine, call your Kennametal Representative or contact us direct. KENNAMETAL INC., Mining Tool Division, Bedford, Pennsylvania, Phone 623-5134.

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# What makes this 3½-yd. P&H the most productive high-front shovel in the business?

**This P&H, with its 48′ high-front has proved its ability to outproduce other shovels in its size range by up to 15%! *Here's why:***

**Speeds cycle time.** Exclusive Magnetorque Swing is unequalled for speed . . . cuts downtime and maintenance costs, too, because it employs magnetic force . . . eliminates friction-type swing clutches. With Magnetorque, there are no stops for clutch adjustment . . . no bands or linings to replace—ever!

**Delivers positive, full power and has the strength to use it.** The 3½-yd. P&H gives you 77,900 lbs. bail pull—more power per cu. yd. of capacity than any competitive unit. P&H Planetary Crowd and Retract uses chain for positive, long-life application of power. The massive strength required to handle this power is provided by P&H-pioneered all-welded construction, using a variety of the strongest alloy steels available.

**Offers superb stability to work effectively at long range.** Long crawlers provide an excellent working base. Live Roller Circle equalizes load distribution, smpoths out swings, cuts maintenance and service costs.

**Provides extra-strength in boom and stick.** Unique boom and straddle-type stick design, proven superior in heaviest mining service, utilizes high-strength alloy steels and advanced engineering to absorb shocks and twist with ease.

**Contact your P&H dealer** for complete information. Or write us for literature.

**HARNISCHFEGER** P&H CONSTRUCTION & MINING DIVISION

*Milwaukee 46, Wisconsin*